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RESEARCH REPORT

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Modeling Choices for Ecological Solid Waste Management in Suburban Municipalities: User Fees in Tuba, Philippines

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Using a participatory approach, this study looks at how a local government in the Philippines might organize and finance solid waste management to meet strict new national targets. Using a "choice modeling" approach, the researchers were able to see how people and companies value the attributes of various waste management services and how much they would be willing to pay for them. The attributes included frequency of waste collection and the methods used to take away the garbage.

Based on survey results and an analysis of waste management costs, the study recommends the option with the lowest maintenance and operating costs and the highest cost recovery levels: once-a-week collection of residual waste by municipal workers with a garbage truck. Even with this option, however, user fees could only partially finance the costs of this service. Achieving the new national standards at even a minimum level would leave a suburban municipality with a "funding gap" of PhP 2 million per year between the costs and expected revenue from user fees.

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MODELING CHOICES FOR ECOLOGICAL SOLID WASTE MANAGEMENT IN SUBURBAN MUNICIPALITIES: USER FEES IN TUBA, PHILIPPINES

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ACRONYMS AND ABBREVIATIONS

BE	-	business establishments
C	-	collector of waste and waste collection vehicle
CAR	-	Cordillera Administrative Region
CM	-	Choice Model
CV	-	compensating variation
CVM	-	contingent valuation method
DENR	-	Department of Environment and Natural Resources, Philippines
EEPSEA	-	Economy and Environment Program for Southeast Asia
EIS	-	Environmental Impact Statement System; Presidential Decree 1586
EKAP	-	Environmental Knowledge, Attitudes and Perceptions
EMB	-	Environmental Management Bureau, line bureau under DENR
ECOSWAM	-	Ecological Solid Waste Management
EO	-	Executive Order of the Philippine President
F	-	frequency of waste collection in a week
FGD	-	focus group discussions
ha	-	hectare, measure of land area equal to 10,000 m^2
HH	-	households
IEC	-	information, education and communication
IRA	-	internal revenue allotment
kg	-	kilograms, measure of weight
km	-	kilometers
km/h	-	kilometers per hour
LGUs	-	Local Government Units, e.g., provinces, cities, municipalities
M	-	million
MOC	-	maintenance and operating costs
m^3	-	cubic meters, measure of volume
mo	-	month
MMDA	-	Metropolitan Manila Development Authority
MRF	-	materials recovery facility
MRS	-	marginal rate of substitution
MWTP	-	marginal willingness-to-pay
NCPAG	-	National College of Public Administration and Governance
NGO	-	Non-government organization
NM	-	non-market
NSWMC	-	National Solid Waste Management Commission
P	-	price of the ECOSWAM service or the garbage user fee
PD	-	Presidential Decree
PhP	-	Philippine peso
PTFWM	-	Presidential Task Force on Waste Management
RA	-	Republic Act of the Philippine Congress
RHU	-	Rural Health Unit
SG	-	Salary grade set by government
SDF	-	Social Development Fund
SLF	-	Sanitary landfill
SP	-	Stated Preference
m^2	-	square meters, measure of land area
SWAPP	-	Solid Waste Association of the Philippines
SWM, SWMB	-	Solid Waste Management, Solid Waste Management Board
SWS	-	solid waste services
UNDP	-	United Nations Development Program
UP	-	University of the Philippines
USD	-	US dollar; 1 USD = PhP 53.15 (March 11, 2005)
wk	-	week
WS	-	waste segregation
WTL	-	waste segregation, type or location of collection and mode of ayment
WTP	-	willingness-to-pay

MODELING CHOICES FOR ECOLOGICAL SOLID WASTE MANAGEMENT IN SUBURBAN MUNICIPALITIES: USER FEES IN TUBA, PHILIPPINES

Dr. Antonia Corinthia C. Naz and Mario Tuscan N. Naz

EXECUTIVE SUMMARY

The Philippines' Republic Act (RA) 9003 or the Ecological Solid Waste Management (ECOSWAM) Act mandates local government units (LGUs) to formulate and implement their ECOSWAM plans. This law sets very ambitious goals, and their achievement will be a major challenge for all sectors of the society. It bans the use of open dumps and requires all LGUs to use only sanitary landfills by year 2006. Compliance with the law implies that the Philippines will need to spend an additional PhP 150 billion (USD 3 billion) for the next 10 years. Many local governments are in a dilemma on how to fund these services. Hence, this study assisted the Tuba municipal government in Benguet province, to examine how to finance the costs of ECOSWAM services through garbage or user fees. It also provided inputs for Tuba's ECOSWAM plan. This EEPSEA study is the first one in the Philippines that used the choice modeling method of contingent valuation to examine the demand for ECOSWAM services in a suburban, rapidly urbanizing area.

The study revealed that the people of Tuba ranked solid waste management as the number one environmental problem but they were not willing to pay a high price to help address this problem. They were willing to pay user fees that could cover only about 22 to 35 percent of the costs of ECOSWAM services. Households were willing to pay an additional PhP 17 (USD 0.30) per month above the base case (the option that meets the minimum requirements of RA 9003), for the option wherein their waste is collected twice a week. This is roughly equivalent to three-fourths of a kilo of rice. Business establishments were willing to pay an additional PhP 4 (USD 0.08) per sack of waste or PhP 17 (USD 0.30) per month above the base case, for their waste to be collected twice a week and a similar amount for their waste to be collected by the municipal workers with a garbage truck. This amounts to about 1.2 liters of gasoline that they were willing to forego in order to pay for ECOSWAM services.

The study recommends that the Tuba municipal government adopt the option with the lowest funding gap, the lowest maintenance and operating costs and the highest cost recovery. This is scenario 1, characterized by once a week collection of residual waste by municipal workers with a garbage truck. Even with user fees, this option will still cost the Tuba municipal government at least PhP 2 million yearly for maintenance and operating expenses. This implies that the Tuba municipal government will have to slice off as much as 25 percent from its development fund to provide these services. If no user fees are collected, it will have to spend about 40 percent of its development fund or 15 percent of its total budget for these services. It will then have to make trade-offs between ECOSWAM services and other social services such as education, health and basic infrastructure.

The study recommends that local governments seriously consider charging user fees to finance, even, partially, the costs of ECOSWAM services. For economic

efficiency, it recommends that neighboring local governments form a cluster for joint ECOSWAM services, that the national government provide matching grants to local governments and tap greater public - private sector participation in ecological solid waste management. It also suggests that policy makers revisit RA 9003 and related laws in order to allow the phased compliance of local governments to this law .

1.0 INTRODUCTION

1.1 Background of the Study

Improper solid waste disposal is often said to be the most important source of environmental concerns for LGUs (Laplante, 2003). In 1997, the International Union of Local Authorities (IULA) and the United Nations Development Program (UNDP) conducted a survey of the problems that mayors worldwide face. Insufficient waste disposal ranked second only to unemployment. Insufficient solid waste (garbage) collection ranked fifth.

In the Philippines, the IULA-UNDP survey also seems to be valid. Solid Waste or basura has emerged as the most visible environmental priority in the cities and municipalities of the Philippines (WB, 2001). In response to a garbage crisis, the first bill that Philippine President Gloria Macapagal-Arroyo signed into law in 2001 was Republic Act No. 9003 or the Ecological Solid Waste Management (ECOSWAM) Act. The Act defines *"solid waste management"* (SWM) as the discipline associated with the control of generation, storage, collection, transfer and transport, processing, and disposal of solid wastes in a manner that is in accord with the best principles of public health, economics, engineering, conservation, aesthetics, and other environmental considerations, and that is also responsive to public attitudes. It defines *"ecological solid waste management"* (ECOSWAM) as the systematic administration of activities which provide for segregation at source, segregated transportation, storage, transfer, processing, treatment, and disposal of solid waste and all other waste management activities which do not harm the environment.

This Act created the National Solid Waste Management Commission and prescribed the establishment of a SWM board in each local government unit (LGU), i.e., province, municipality, city and barangay[i] and the formulation of 10-year local ECOSWAM plans. The Act states that the LGUs shall be primarily responsible for the implementation of ECOSWAM services. It authorizes the Local SWM Board to impose fees on the SWM services that the LGU or any authorized organization provides and pool these fees into a solid waste management fund. These fees shall be based, interalia, on the (a) types of solid waste, (b) amount/volume of waste, (c) distance of the transfer station to the waste management facility, (d) capacity or type of LGU constituency, (e) cost of construction, (f) cost of management and (g) type of technology. The barangay and the municipality may collect fees. [ii]

The Act has set very ambitious goals, and their achievement will be a major challenge for all sectors of the society. The Act requires all LGUs to use sanitary landfills (SLF) by year 2006. As of 2003, there are 726 open dumpsites, 215 controlled dumps and two sanitary landfills. There are about 220 proposed sanitary landfills to be

established nationwide. The cost of SLF construction averages PhP 7 million per ha. Annual maintenance and operating costs also constitute a recurring expense. Many LGUs cannot afford these. A back-of-the-envelope analysis indicates that the Philippines will need to spend an additional PhP 150 billion (USD 3 billion) for the next 10 years for SWM or an additional per capita cost of PhP 200 per year. The average annual costs of implementing the law amount to 0.5 percent of the year 2000 gross domestic product (GDP) (DBM, National Income Accounts, 2001). If this was funded solely by the government, it would require the programmed public expenditure in the national budget to increase annually by three percent from its current level and the local government programmed expenditure to increase by at least 15 percent (WB, 2001).

According to the DENR-NSWMC's 2004 Report, "Each year in Metro Manila, over PhP 3.54 billion (USD 64 million) are spent on garbage collection and disposal. For every man, woman and child, PhP 295 (USD 6) or one to 12 percent of a local government's budget is spent on garbage. On the average, less than PhP 25 (USD 0.45) is collected per capita on a "user pays" basis to recover costs, the remainder being provided by central funding. In general, only businesses are assessed fees and then at extremely low levels. In general, the system is heavily subsidized by local governments and thus is financially unsustainable."

According to the DENR-NSWMC (2004), sources of funds for ECOSWAM services consist of (a) General budgetary appropriations, including locally generated taxes, fees and charges; Internal Revenue Allotment (IRA) and other income to which the LGUs are entitled; (b) External sources, e.g., Countryside Development Fund (CDF); credit finance instruments; local and foreign-funded loans and grants, and private sector participation; and (c) Garbage fees and fines for violations. Garbage fees collected by LGUs go to their general fund. For 2001, garbage fees vary from a minimal 0.4 percent to 3.2 percent of the total income in Metro Manila.

Costs are of primary concern in implementing ECOSWAM since the municipal government of Tuba is heavily dependent on its internal revenue allotment (IRA) from the national government.[iii] Its IRA comprises about 82 percent of its income. Its annual budget is only about PhP 40 million (USD 752,587).[iv] Of this amount, 20 percent or PhP 8 million (USD 148,148) is termed the development fund. The budget for ECOSWAM will have to be taken from this fund. The Tuba municipal government believes that it does not have enough budget to provide ECOSWAM services, so it plans to charge 'garbage fees' or 'user charges'. However, Tuba does not know how much garbage fees to charge and how to collect them. The study was undertaken to assist Tuba in designing these fees and hence, provide a sound basis for the formulation of Tuba's ECOSWAM policies.

The Tuba municipal government plans to prioritize the provision of ECOSWAM services in three congested barangays, i.e., Poblacion along Marcos Highway, Barangay Camp 4 along Kennon Road and Barangay Tadiangan along Asin Road and Naguilian Road. These barangays are non-contiguous, i.e., one has to pass through Baguio City before reaching the other barangays.

1.2. Objectives of the Study

General Objective: To determine how suburban municipalities like Tuba, Benguet in the Philippines can finance ecological solid waste management (ECOSWAM) services through user fees.

Specific Objectives: Specifically, this EEPSEA study aimed to:

i. Determine the choices of the people of Tuba, Benguet, namely, the (a) households and (b) business establishments, on the attributes of different ECOSWAM options or programs such as waste collector and collection vehicle, waste segregation, collection frequency, type or location of waste collection and mode of payment and the garbage or user fee that they are willing to pay for each option;

ii. Formulate econometric models describing the relationship between the utility the respondents shall derive from their preference or choice of ECOSWAM service options and the determinants of these preferences or choices;

iii. Estimate the welfare effects, i.e., the implicit prices or the marginal willingness-to-pay of the people of Tuba for an additional unit of a non-market (non-price) attribute of an ECOSWAM service option;

iv. Estimate the potential revenues from the proposed garbage or user fees from (a) households and (b) business establishments in Tuba; and

v. Determine the funding gap, if any, between the potential revenues from the garbage fees and the estimated maintenance and operating costs (MOC) of the ECOSWAM services.

1.3. Policy, Scientific Relevance and Significance of the Study

The study shall provide the Tuba municipal government with a guide for decision-making and policy formulation on the choice of the option(s) for ECOSWAM, the setting of the garbage user fees, the costs of the ECOSWAM service options and the additional amount that it will have to raise in order to finance its ECOSWAM services. This study shall be used as the basis for the formulation of their ECOSWAM ordinances and shall provide inputs to the Tuba ECOSWAM plan. This is the first study in the country that uses the stated preference method: choice modeling to determine the preferences of people on ECOSWAM services in a suburban municipality. Thus, it shall serve as a comparative study with other studies that used the same methodology in other countries, e.g., Malaysia (see J. Othman, EEPSEA 2002).

2.0 REVIEW OF RELATED STUDIES

2.1. Demand and Willingness to Pay for Solid Waste Management Services

Gottinger (1991) found out that the demand for solid waste collection service depends on the volume of wastes generated, the quantity of refuse the residents want collected and the quality of collection service. Income, price, and personal taste influence the amount placed out for collection. For higher disposable personal income levels, a higher level of service will be demanded. Solid waste collection service is assumed to be a normal good. As the price of the services in a community rises, less will be demanded. Jenkins (1993) analyzed the impact of service-level-based user fees and found that frequency of collection visits and the location of collection (backyard versus curbside) affect waste quantities.

In 1998, the WB-SWEEP project assessed the WTP for integrated solid waste management-collection and disposal using the closed iterative bidding contingent valuation method. Respondents agreed to pay a monthly fee of PhP 26.54 in Iloilo City and PhP 23.30 in Naga City for garbage collection alone and PhP 34 in Iloilo City and PhP 31.60 in Naga City for collection and disposal. Jamal Othman (EEPSEA 2002) employed choice modeling and contingent valuation to elicit households' willingness-to-pay for different solid waste management options. The user fee, waste collection frequency, waste collection vehicle significantly influenced the households' utility. Household characteristics like income, concerns on SWM issues, number of bags of wastes, knowledge of recycling programs and whether or not respondents practiced waste separation were found to be significant in his study. He found out that households place a high value on improvements in SWM.

2.2. Costs of Solid Waste Management Services

Cities in developing and industrialized countries generally do not spend more than 0.5 percent of their per capita gross national product on urban waste services (World Bank, 1999). Expenditures in SWM also serve as a reliable proxy to service levels for collection and disposal. Maintenance and operations costs in low income countries show that about 20 to 50 percent of city revenues are spent for SWM, while high income countries spend 1 to 10 percent of their revenues on SWM. SWM costs to government are lower in high income countries because of private sector participation, higher labor and vehicle productivity and greater efficiency (Cointreau-Levine and Gopolan, 2000). A study of 41 LGUs in the Philippines argues otherwise; LGUs that hire private contractors incur higher costs (Sumalde, 2005). Low-income LGUs do not have the financial capability, although they may have budget autonomy. Their solid waste management costs per capita are close to that of high-income LGUs, but not their budget per capita. It is therefore, necessary for the central government to provide technical assistance projects aimed at improving their lot, as opposed to LGUs whose incomes are on the higher end of the scale (WB-SWEEP, 1998).

The WB-SWEEP study (1998) showed that, on average, an LGU spends about: PhP 63 per capita per year for SWM services; PhP 562 on average, for collection, transfer and disposal of one cubic meter of solid waste (unsegregated) and PhP 1,605 on average, for the collection, transfer and disposal of one metric ton of solid waste. In Bais City, Negros Oriental, the cost for the acquisition, design and construction of a sanitary landfill is about PhP 7 million per ha (USAID-ECOGOV Policy Forum, March 2005). Table No.1 shows the estimated capital and operating costs of providing ECOSWAM services (JBIC, 2003).

Table 1: Estimated Costs of Sanitary Landfill Construction and Operation

City	Cost of Sanitary Landfill, SLF (PhP Million)	Capacity, ('000 m^3)	Useful Life of SLF, years	Total Capital Investment Cost* (PhP'000)	Annual Operating Cost ** (PhP'000)	Proposed Mode of Financing
Legaspi City	96	280	8.4	256,520	9,749	Loan
Butuan City	113	620	15	305,360	10,721	Loan
Muñoz City	99	510	8-11***	196,570	5,602	Loan

*These include the cost of the SLF and other infrastructure like material recovery facilities, compost plant, leachate treatment plant and collection vehicles

** These include personnel, electricity, fuel, repair, supplies, etc.

***The life of the SLF would be shorter in case it accepts wastes from surrounding municipalities and cities

2.3. Financing of Solid Waste Management Services

Schubeler (in UNDP/UNCHS, 1996) mentions three main options for financing the recurrent costs of municipal SWM: user charges, local taxes and intergovernmental transfers. To promote the responsiveness of the supplying agency to user needs and ensure that collected funds are actually applied to waste management, it is preferable to finance operations through user charges rather than general tax revenues. Adding solid waste charges to utility charges may increase collection efficiency. User charges should be based on the actual costs of solid waste management, and related to the volume of collection service provided. Among larger waste generators, variable fees may be used to manage the demand for waste services by providing incentive for waste minimization. To achieve equity of waste service access, some cross-subsidization and/or financing out of general revenues will be required.

Transfers from national governments (NG) to local governments may encourage specific type of expenditures, such as education, health, or environmental protection. Conditional or matching grants will create that incentive and may therefore induce investment at a lower cost (smaller transfer) for the national government. These grants effectively reduce the relative cost of providing sanitary landfill services relative to the cost of providing other local public goods. For example, in the United States, the Federal Government offers up to 90 percent of grants for the construction solid waste management facilities. On the ground of both economic efficiency and equity, transfers from NG to LGUs are justified to support the costs of improving solid waste management facilities, and to support the incremental costs associated with the adoption of sanitary landfills. If possible, the NG may wish to provide technical and/or financial assistance to clusters of LGUs to help reduce the transaction costs associated with the negotiation and design of the contractual agreement (Laplante, 2001).

Cointreau-Levine (2000) posits that the collection of user charges enables the service to be financially sustainable. Surveys can indicate which methods of waste collection are preferred and also provide information on households' ability to pay for the service. In developing countries, most local governments experience a serious shortfall in meeting their revenue needs from their tax base. User charges, as one means to cover solid waste costs, should not be neglected, even though most solid waste management services are public goods. User charges give the solid waste agency some autonomy by eliminating the need to compete with other government agencies for their share of general revenue.

Urbanized cities in the Philippines, like Olongapo, Lipa, Batangas and Cagayan de Oro, have some degree of success in collecting monthly garbage or user fees ranging from PhP 10 to PhP 40 for households and PhP 75 to PhP 3,000 for commercial and industrial establishments. (WB-SWEEP, 1998). Olongapo City became the first city in the Philippines to implement direct user charges in 1991. It achieved a cost recovery of 35 percent of the total SWM costs by charging a fixed fee built into the electricity bills.

Bennagen (2003) examined the impacts of a unit pricing system in the disposal of solid wastes in Olongapo City. A unit pricing scheme will result in an incremental reduction of about 3,305 tons of waste annually. About PhP 860,000 per year in avoided costs can be realized by the city in SWM in the first three years, and savings of up to PhP 2.9 million annually in the succeeding periods.

Sumalde (2005) investigated how LGUs finance ECOSWAM services. For Solid Waste Association of the Philippines (SWAPP) - listed LGUs, the average unit costs of solid waste was PhP 255 per m^3 and PhP 795 per household. In non-SWAPP listed LGUs, per unit cost is PhP 301 per m^3 of waste and PhP 646 per household. Only two LGUs earn from garbage fees incorporated in either the water bill or the electric bill. Gottinger (1991) suggested that more in-depth research needs to be done on the most appropriate method of assessing and collecting user charges for a solid waste collection system. Bennagen (2003) also recommends the same.

3.0 RESEARCH METHODS

3.1 The Project Site

Tuba is a second-class municipality that shares common borders with first class, highly urbanized Baguio City. Tuba is approximately 7 km. west of Baguio City and 238 km. north of Manila. It is the radiation area of the developmental and spillover activities of Baguio City in terms of education, commerce, industry, housing, tourism and solid wastes. Its Santo Tomas watershed serves as a vital water source for Baguio. It has a total land area of 43,428 hectares, with an elevation of around 5,000 feet above sea level. Owing to its rugged terrain, 57 percent of its area has a slope of 50 percent and above (very steep). Tuba has two pronounced distinct seasons, a wet season from May to October and a dry season during the rest of the year. It has 13 barangays with a total population of 39,525 or 7,391 households (Tuba RHU, Dec. 2004). Many of Tuba's barangays are non-contiguous, i.e., one has to pass through Baguio City in order to go to the other barangays of Tuba. Twelve high-density housing subdivisions are under construction in Tuba. Its major economic activities are agriculture, livestock production, tourism, mining and cottage industries.

Tuba does not yet have a municipal-wide solid waste collection and disposal system. Each household and business establishment is responsible for its own SWM. Waste generation from a Tuba household is estimated to be 0.33kg per capita (EMB-CAR, 2003). Tuba residents dispose of their solid wastes through burying, dumping in individual pits, composting, burning, feeding to animals, open dumping and other means (Tuba RHU, 2004).[v] The Tuba Mayor organized the municipal solid waste management board (MSWMB) in July 2001. Then, he re-organized this as the

ECOSWAM board in August 2004 and created the ECOSWAM Technical Working Group with technical assistance from this EEPSEA project. The municipal council also adopted Resolution 282, series 2003 adopting an LGU-wide ECOSWAM program. A local resident donated one hectare of land for Tuba's waste disposal site. The Tuba municipal government plans to purchase from the said donor, an adjoining one hectare of land as an additional disposal area.

3.2 Stated Preference Approach or Choice Modeling

The researchers used the stated preference (SP) approach. The SP analysis has its roots in conjoint analysis where individual judgments of multi-attribute stimuli are represented (Adamowicz, et. al.,1999, Batsell and Louviere, 1991). The particular type of conjoint analysis used here is the experimental analysis of choice. This particular approach parallels the Random Utility Model (RUM) structure (see McFadden, 1974; Ben-Akiva and Lerman, 1985) that is common in referendum contingent valuation (CV) models (Mitchell and Carson, 1989) and in discrete-choice travel-cost models (Bockstael et al., 1991).

Each alternative (i) in the choice set has an associated utility level represented by (Adamowicz, et. al., 1999:465)

$$U_i = V_i + \varepsilon_i \qquad (1)$$

This utility is composed of an objective component (V_i) and an error component (ε_i). The study assumes that the utility for an option *(i)* depends on a vector of its observable attributes, (Z) and a vector of the socio-economic characteristics and environmental knowledge, attitudes, practices and perceptions of the respondents, (S).

$$U_i = V_i(Z_i, S_i) + \varepsilon_i(Z_i, S_i) \qquad (2)$$

This function is also known as a conditional indirect utility function since it is conditional on the choice of the option *(i).* Selection of one option (package of attributes) over another implies that the utility (U_i) of that option is greater than the utility of another option say *j* (U_j). Since overall utility is random, one can only analyze the probability of choice of one option over another, or

$$Pr\{i \text{ chosen}\} = Pr\{V_i + \varepsilon_i > V_j + \varepsilon_j \ \forall j \in C\} \qquad (3)$$

Where *C* is the choice set

Specific choices of error distributions lead to methods for the estimation of the parameters of this utility function and to quantitative representations of trade-offs between attributes. An assumption of Type I extreme value distributed errors produces the conditional logit specification of the probability choice, or the probability of an individual choosing an alternative i can be written as the following closed-form multinomial logit model (MNL):

$$Pr\{i\} = \frac{e^{Vi}}{\sum_{j \in C} e^{Vj}} \qquad (4)$$

Equation (4) can be estimated using multinomial logistic regression. The Random Utility Model described above provides the theoretical basis for the experimental-choice process. This model is also the basis for the referendum model of contingent valuation (CV). Thus, both techniques arise from the same theoretical background. SP, however, typically entails repeated measure responses from the individual while CV does not (Adamowicz, et. al.,1999:465.).

The V_j are assumed to be linear, additive functions in the attributes (Zs or Xs) which determine the utility of the jth alternative. Let q represent an individual and let V_j be written as :

$$V_{jq} = \sum_{k=1}^{k} \beta_{jk} X_{jkq} \qquad (5)$$

An estimate of β_{jk} can be interpreted as an estimate of the weight of attribute k in the utility expression V_j of alternative j. Given estimates of the βs, an estimate of V_{iq} can be calculated by taking the βs and the Xs for individual q and alternative i and using the equation above. The resulting V_{iq} can be interpreted as an estimate of the (relative) utility U_{iq} to individual q (Louviere, et. al., 2000:51). A characteristic of an individual or any other variable that is not an attribute of an alternative in a choice set, cannot be included as a separate variable in all utility expressions since it does not vary across the alternatives. To enable a non-modal attribute to be included in all utility expressions, it must be interacted with an alternative specific-attribute. (Louviere, et. al., 2000: 63).

The contingent valuation method uses survey questions to elicit people's preferences for public goods by finding out what they would be willing to pay for specified improvements in them. Generally, CVM is used when the willingness-to-pay (WTP) for the environmental good or service in total is needed. However, when WTP for individual attributes, such as those that characterize an ECOSWAM, service is needed, choice modeling (CM) is used. It is able to elicit information on relative values for different attributes of a public good or service. The contribution of each attribute to the choice process can be calculated. Questions such as `what are you willing to pay?' are thought by some critics of CVM to present cognitive problems. Choice modeling, however, does not explicitly ask about money values so it is argued that CM is easier for people to understand. Choice modeling offers a more `efficient' means of sampling than CVM since, typically, more responses are obtained from each individual with CM than with CVM (Bateman, et.al., 2002). Choice modeling or the experimental analysis of choice or the attribute-based method (ABM) (Adamowicz, 2002) was used to determine the preferences on the ECOSWAM services of the households and business establishments and their willingness-to-pay for these (Adamowicz, et. al., 1999:461).

The steps in the Stated Preference method are: (1) Identification of the set attributes; (2) Selecting the measurement unit of each attribute; (3) Specification of the number and magnitude of attribute levels; (4) Experimental design, (5) Survey instrument design; (6) Model estimation and (7) Use of parameters to stimulate choice (Hensher 1994, as cited by Adamowicz in Bateman and Willis, 1999:462).

For steps one to three, the researchers held focus group discussions (FGD), one-on-one interviews and seminar-workshops with local officials and residents in Barangays, Poblacion, Camp 4, and Tadiangan of Tuba. These were to determine the important attributes of an ECOSWAM service, how they should be measured and the number of levels per attribute, i.e., the degree or quality of each attribute devise some parts of the questionnaire. The researchers also participated in the monthly meetings of the Tuba ECOSWAM board, the public consultations on the proposed disposal site and site inspection. In step four, which is unique to SP and is one of its advantages, experimental designs were used to array attributes and levels into choice sets. The researchers designed the arrays of the ECOSWAM attributes, the 'product' descriptions and the choice sets. In step five, the "referendum" method was used as the basic framework of the questionnaire design. In the case of public goods, the referendum model is preferred as it invokes the correct payment context and the full range of values appropriate to public goods. Posing the elicitation question in the form of a referendum enables citizens to make binding decisions about the provision of public goods (Mitchell and Carson, 1989).

In each choice set, a varying alternative was presented along with a fixed base case. The base case is that option which is perceived to be the simplest and cheapest option to meet the minimum requirements under RA 9003. The status quo of burning and open dumping of waste did not constitute the base case since this is no longer acceptable under RA 9003. Two sets of questionnaires were designed- first, for the survey of the households and second, for the business establishments. These consisted of the following sections: (1) Introduction to the study and to the solid waste situation in Tuba; (2) Environmental Knowledge, Attributes and Perceptions (EKAP); (3) ECOSWAM service choice sets; (4) Debriefing Questions; (5) Solid waste management practices, (6) Socio-economic Characteristics; and (7) Questions about the Questionnaire. The questionnaires were refined and translated into the Ilocano dialect during the training-workshops with the enumerators in the three barangays. The questionnaire for the household survey was further refined after the pilot study of 200 households and two pre-tests. The questionnaire for the business establishments underwent the same process of refinement, except that it had only one pre-test because of the experience gained with the questionnaire for the households.

The research team administered the questionnaires through face-to-face or in-person interviews. To give the households time to think, the enumerators asked them how sure they were of their answers to each choice set in a scale of 1 to 5. The respondents could change their answers until such time that they were very sure of their final answer. To give the business establishments time to think, the enumerators also asked them the reasons for their final answer in each choice set.

In steps six and seven, econometric modeling was done for the households and business establishments separately using conditional logit regression. The LIMDEP statistical software was used to generate the choice models. The respondent was asked to select the 'preferred' option (described by attributes at various levels) from a choice set.

3.2.1. Ecological Solid Waste Management (ECOSWAM) Services Preferences of Households

3.2.1.1. Attributes and Levels of Proposed ECOSWAM Services for Households

Table 2: The Attributes and Levels of the Proposed ECOSWAM Services for Households

Attributes of an Ecological Solid Waste Management Option	Level, **L**	Description	Codes
Collector of Waste, and transport vehicle **C**	1	Barangay workers with hired jeepney	0
	2	Municipal workers with garbage truck	1
Frequency or No. of Times of Waste Collection in a Week, **F**	1	Once	1
	2	Twice	2
Waste Segregation, Type/Location of Waste Collection and Mode of Payment, **WTL** WTL 1	1	Waste Segregation Required Modified pick-up and "Pay as you throw"	1,0
WTL 2	2	Waste Segregation not required Modified pick-up and "Pay as you throw"	0,1
	3	Waste Segregation not required Curbside and "Pay to the barangay treasurer"	0,0
Garbage fee in Philippine Pesos, **PhP**	1	5/ wk or 20/ mo	5
	2	10/ wk or 40/ mo	10
	3	15/ wk or 60/ mo	15
	4	20/ wk or 80/ mo	20

*Note: The researchers recoded the two-level attributes of waste segregation (WS), and type or location of collection and mode of payment (TL) into a single three (3) level attribute, WTL.

3.2.1.2. Experimental Design and Sampling Design

The household survey involved a 2^4 x 4 main effects factorial experimental design. A fractional factorial experimental design containing 24 options divided into 3 blocks was used. The experiment compares a constant fixed alternative (base case) against a varying alternative in each choice set. Each respondent evaluated eight choice sets in the block assigned to his barangay. An example of a choice set is:

- -

Suppose you are asked to vote on the kind of ecological solid waste management service that you want to receive. Please vote considering your current income, budget, household expenses and the attributes or features of the ECOSWAM options presented to you. If there are only two options, what option would you vote for, "1" or "2"? Please "√" your choice.

Figure 1: **BLOCK A, CHOICE SET 2**

Attributes of an Ecological Solid Waste Management Service	**Options**	
	1	**2**
A. Collector of Waste	Municipal workers with garbage truck 	Barangay workers with hired jeepney 
B. Waste Segregation at Source *	Waste Segregation not required • Workers will be hired to segregate wastes after they are collected 	Waste Segregation required • No segregation, no collection 
C. Frequency or No. of Times of Waste Collection in a Week	Twice	Once
D. Location of Waste Collection and Mode of Payment of Fee *	Curbside and "Pay to the barangay treasurer"	Modified pick-up and "Pay as you throw"
E. Garbage fee in Philippine Pesos, PhP	20 per week Or 80 per month	5 per week Or 20 per month

Please check your choice ☐ ☐

- -

- *Note: Attributes waste segregation and location of waste collection and mode of payment of fee were recorded into a 3 level attribute, WTL*

Random cluster sampling was used. In each sitio or sub-barangay to be covered by the ECOSWAM service, the researchers took as sample, every third household from the list of households. The sample size for the household survey consisted of 604 respondents or at least 200 respondents from each of the three priority barangays. According to Mitchell and Carson (1990:225), the usable sample sizes needed for respondents from the households and business establishments are shown in Table 3

Table 3: Sampling Size for Households and Business Establishments

Respondents	Usable Sample Size V= 2.0 , α = 0.10		Sample Size	Population (2004)	Sample Size as a Percent of Total Population
	Δ = 0.15	Δ = 0.30			
Households	508		600	7,391	8.12
Business establishments (with business permits)		127	150	731	20.5

Where: V = coefficient of variation
Δ = possible deviation as a percentage of the mean revealed WTP
α = 0.10 indicates that 90% of the time estimated mean WTP will be within Δ of true mean WTP

3.2.1.3. The Definition of Variables and the Econometric Models

Models for Households

Model 1: Basic Model (ECOSWAM Attributes only) of the Base Case

$V_{iH} = f(X_{k,} \varepsilon_H)$ (6a)

$V_{iH} = ASC_H + \beta_{1H} * C + \beta_{2H} * F + \beta_{3H} * P + \beta_{4H} * WTL1 + \beta_{5H} * WTL2$ (6b)

Model 2: Complete or Expanded Model (ECOSWAM attributes interacted with the characteristics of the households) of the Base Case

$V_{iHC} = f(X_{k,} Z_{mH,} \varepsilon_H)$ (7)

Where: i = option = 1, 2; option 2 is the base case in the choice set
V_{iH} = The probability that the household (respondent) will choose the ith option in the choice set
X_k = Attributes of the ECOSWAM options (see Table 3.1)
ASC_H = Alternative specific constant for households
β_k = Coefficients of the attributes, X_k
Z_{mH} = Individual characteristics of the household (H) interacted with the attributes of the ECOSWAM service options
α_{mH} = Coefficients of the Z_{mH} interacted with a X_K
ε_H = Error term to explain other factors affecting the choice that are not included in the model for households
Subscript H = Basic Household Model 1
Subscript HC = Complete or Expanded Household Model 2

Table 4: Variables in the Choice Models for the Households

Variable / Coefficient	**Description and Codes**
Dependent Variable V_{iH}	The probability that the household (respondent) will choose the ith option in the choice set
Independent Variables	
X_k	**Attributes of ECOSWAM Services**
C	Collector of waste and waste collection or transport vehicle Level 1: barangay workers with hired vehicle, e.g., jeepney (0) Level 2: municipal workers with truck (1)
F	Frequency or number of times waste is collected in a week Level 1: Once a week (1); Level 2: Twice a week (2)
P	Price of the ECOSWAM service or the user fee Level 1: PhP5/week(5) Level 2: PhP10/week(10) Level 3: PhP15/week(15) Level 4: Php20/week(20)

Variable / Coefficient	Description and Codes
WTL1 WTL2	Recoded Variables: Waste segregation at source, type or location of waste collection and mode of payment Level 1: segregation required, modified pick-up and pay as you throw WTL1 = 1; WTL2 = 0 (dummy codes) Level 2: segregation not required, modified pick-up and pay as you throw; WTL1 = 0; WTL2 = 1 Level 3: segregation not required, curbside and pay to the barangay treasurer; WTL1 = 0; WTL2 = 0
	Socio-Economic Variables Interacted with Attributes
1. EKAP x WTL1 x WTL2 x P	Environmental Knowledge, Attitudes and Perceptions: Summation of scores from A1, A2, A3, and A4; divided by total number of items
2. REC x WTL1 x WTL2	If respondent's household practices recycling or re-use of waste materials Yes = 1 Otherwise = 0
3. COM x WTL1 x WTL2	If respondent's household practices composting Yes = 1 Otherwise = 0
4. QB x F x P	Estimated biodegradable waste disposed by the respondent's HH, in kg
5. QNR x F x P	Estimated non-biodegradable, residual waste disposed by the respondent's HH, in kg
6. IB x WTL1 x WTL2	Presence of Indigenous Beliefs on Solid Waste Management Yes = 1 Otherwise = 0
7. EDUC x P	Years of formal schooling
8. GENDER x P	Gender of respondent ; Male = 1 Female = 0
9. HHSIZE x P	Number of HH members
10. DECI x P	If respondent is sole decision maker Yes = 1 Otherwise = 0
11. HHINC x	Total Household Income
12. HOUSE x F x P	Ownership of house; Yes= 1 Otherwise = 0
13. ROOMS x P	Number of rooms in the house (if owner of house)
14. ASSETS x P	No. of assets, e.g., house appliances, vehicles
15. LAND x F x P	Ownership of land; Yes= 1 Otherwise = 0
	Constant term
A_A1	Alternative Specific Constant term in the basic model with attributes only
A_B1	Alternative Specific Constant term in the expanded choice model: attributes interacted with household characteristics
	Error term
ε_H	Error term for household model

3.2.2 Ecological Solid Waste Management (ECOSWAM) Services Preferences of Business Establishments

3.2.2.1. Attributes and Levels of the Proposed ECOSWAM Services for Business Establishments

The attributes and levels of the proposed ECOSWAM services for business establishments are similar to those of the households except that the garbage fee is per sack (volume) and that the type and location of waste collection is modified pick-up. Since the latter attribute is the same for all business establishments, this was no longer included among the alternative specific attributes.

Table 5: Attributes and Levels of the Proposed Ecological Solid Waste Management for Business Establishments

Attributes of an Ecological Solid Waste Management Option	Level, **L**	Description	Codes
Collector of Waste and Transport Vehicle, **C**	1	Barangay workers with hired vehicle	0
	2	Municipal workers with garbage truck	1
Waste Segregation Source, **WS**	1	Waste Segregation required No segregation, no collection	0
	2	Waste Segregation not required Workers will be hired to segregate wastes after they are collected	1
Frequency or No. of times of Waste Collection in a Week, **F**	1	Once	1
	2	Twice	2
Garbage fee per sack, in Philippine Pesos, **PhP**	1	8	8
	2	10	10
	3	15	15
	4	20	20

An example of a choice set is:

Suppose you are asked to vote on the kind of ecological solid waste management service that you want to receive. Please vote considering the current income, budget and expenses of your business establishment and the attributes or features of the ECOSWAM options presented to you. If there are only two options, what option would you vote for, "1" or "2"? Please "√" your choice. Then, please tell me the reason for your choice.

Figure 2: **BLOCK C, CHOICE SET 1**

Attributes of an Ecological Solid Waste Management Service	**Options**	
	1	**2**
A. Collector of Waste	Municipal workers with garbage truck 	Barangay workers with hired vehicle 
B. Waste Segregation Required	Yes No segregation, no collection 	Yes No segregation, no collection 
C. Frequency or No. of Times of Waste Collection in a Week	Twice	Once

Attributes of an Ecological Solid Waste Management Service	Options	
	1	2
D. Garbage fee per sack of waste, in Philippine Pesos, PhP	15 per sack 	8 per sack 

Please check your choice ☐ ☐

Why did you choose this option? _____ _____

3.2.2.2. Experimental and Sampling Design

The study for the business establishments involved a 2^3 x 4 main effects factorial design. A fractional factorial experimental design with 24 options divided into 3 blocks was used. Each respondent evaluated eight (8) choice sets. Each choice set compared a constant fixed alternative (base case) or option 2 against a varying alternative in each choice set. The researchers took a sample of 150 business establishments from the three priority barangays. Samples were taken to represent each type of business establishment. Every 50 business establishments were given one block of choice sets to answer.

3.2.2.3. The Definition of Variables and the Econometric Models

Model 1: Basic Model (ECOSWAM Attributes only) of the Base Case

$$V_{iB} = f(X_{k,} \varepsilon_B) \quad (8a)$$

$$V_{iB} = ASC_B + \beta_{1B} * C + \beta_{2B} * WS + \beta_{3B} * F + \beta_{4B} * P_B \quad (8b)$$

Model 2: Complete or Expanded Model (ECOSWAM attributes interacted with the characteristics of the business establishments) of the Base Case

$$V_{iBC} = f(X_{k,} Z_{mB,} \varepsilon_B) \quad (9)$$

Where:
- i = option = 1 , 2 (where option 2 is the base case in the choice set)
- V_{iB} = The probability that the business establishment will choose the ith option in the choice set
- X_k = Attributes of the ECOSWAM options
- β_k = coefficients of the attributes, X_k
- ASC_B = Alternative specific constant for business establishments (zero for base case
- Z_{mB} = Individual characteristics of the business establishment (B) interacted with the attributes of the ECOSWAM service options
- α_{MB} = Coefficient of the Z_{MB} interacted with a X_K
- ε_B = Error term to explain other factors affecting the choice that are not included in the model for business establishments
- Subscript B = Basic Business establishment Model 1
- Subscript BC = Complete or Expanded Business establishment Model 2

Table 6: Variables in the Utility Equation for the Business Establishments

Variable / Coefficient	Description and Codes
Dependent Variable V_{iB}	The probability that the business establishment will choose the ith option in the choice set
Independent Variables	
	Attributes of the ECOSWAM service
C	Collector of waste and waste collection or transport vehicle Level 1: barangay workers with hired vehicle, e.g., jeepney (0) Level 2: municipal workers with truck (1)
F	Frequency or number of times waste is collected in a week Level 1: Once a week (1); Level 2: Twice a week (2)
P	Price of the ECOSWAM service or the user fee Level 1: PhP8/sack (8), Level 2: PhP10/sack (10) Level 3: PhP15/sack (15), Level 4, PhP20/sack (20)
WS	Waste segregation at source Level 1: segregation required (0), Level 2: segregation not required (1)
	Socio-Economic Variables Interacted with Attributes
1.EKAP x WS x P	Environmental Knowledge, Attitudes and Perceptions: Summation of scores from A1, A2, A3, and A4; divided by total number of items
2. REC x WS	If respondent's household practices recycling or re-use of waste materials Yes = 1 Otherwise = 0
3. COM x WS	If respondent's household practices composting Yes = 1 Otherwise = 0
4.QB x F x P	Estimated biodegradable waste disposed by the respondent's BE, in kg
5. QNB x F x P	Estimated non-biodegradable, residual waste disposed by the respondent's BE, in kg
6. IB x WS	Presence of Indigenous Beliefs on Solid Waste Management Yes = 1 Otherwise = 0
7. YR x C	Years of business operations
8. WK x F	No. of days in a week the BE is opened
9. CAP x P	Capitalization/Size of BE Level 1: Small and medium-sized business establishment (1) Level 2: Large business establishment (0)
10. NOW x P	Total number of workers in BE, including owner and manager
11. NETINC x P	Gross Monthly Business Revenues less basic operating expenses like electricity, water and telephone bills
12. DEC x P	Decision-maker on expenditures for the BE. Yes = 1, Otherwise = 0
13. LAND x WS x P	Total land area BE occupies, sq m
14. FLRA x WS	Total floor area of the stall or office space of the BE, sq m
15. RD x WS x P	Distance of BE from the main road where a garbage collection vehicle can pass by, meters
16. SWME x P	Expenditures on solid waste management/sanitation
	Constant term
ASCB1	Alternative Specific Constant in the basic choice model with attributes only
ASCB2	Alternative Specific Constant in the expanded choice model: attributes interacted with socio-economic variables
	Error term
ε_B	Error term for business establishments'model

3.3 Implicit Prices or Marginal Willingness-to-Pay

Choice models can be used to estimate the responsiveness of a population group to changes in levels of particular attributes of a good or service, to marginal rates of substitution (MRS) between attributes (trade-offs) and to obtain individual and group estimates of the likelihood of choosing a particular good, service or activity, given the levels of the attributes offered as the significant choice discriminators (Louviere, et. al. 2000:58). Otherwise called implicit prices, these indicate the willingness-to-pay (WTP) for an additional unit of a non-market or non-price attribute, *ceteris paribus* or the marginal WTP (MWTP).

$$MWTP = MRS = \beta_{NM} / \lambda_Y \qquad (10)$$

Where: β_{NM} = coefficient of a non-market attribute
λ_Y = coefficient of the price attribute; marginal utility of income

3.4. Potential Revenues from the Estimated User Fees

The researchers used a public valuation frame, i.e., the ECOSWAM service was treated as a public good. The study calculated the potential revenues using the base case (minimum compliance to RA 9003) as the reference and three alternative ECOSWAM service scenarios or options that the Tuba Municipal government was considering to provide to its constituents. The base case prices for the households and the business establishments were taken from the FGDs; they do not represent the real minimum price or the user fees that people were willing to pay for the ECOSWAM service. The focus of the study is on the marginal revenues, i.e., how much people were willing to pay above or on top of the base case in order to avail of higher service levels offered by the other alternatives, and to move from one alternative to another. The researchers also calculated the percent contribution of the user fees to the financing of the ECOSWAM service or the cost recovery. The annual marginal revenues (MR) for each of the alternative scenarios or options were calculated as follows:

$$MR_H = \Sigma [MWTP_H \times X_{kH}] \times N_H \times 12 \text{ (months per year)} \qquad (11)$$
$$MR_B = \Sigma [MWTP_B \times X_{kB}] \times N_B \times 12 \text{ (months per year)} \qquad (12)$$
$$MR_T = MR_H + MR_B \qquad (13)$$

Where: N = number of households or business establishments to be covered by the ECOSWAM service; X_k = Attributes of the ECOSWAM options
subscripts: H = households; B = business establishments; T = total

The computation of the annual marginal revenues presents a "snapshot" of the dynamic solid waste management continuum. As the population increases, the amount of waste will increase and the revenues from the garbage user fees will also increase.

3.5. Costs of the ECOSWAM Options

The study computed for the annual maintenance and operating costs (MOC) for the base case of the ECOSWAM service and three alternative scenarios or options. The focus is on the marginal costs, with the base case as the reference. The capital investment costs, e.g., development of the waste disposal site, building facilities and purchase of equipment and vehicles shall be borne by the municipal government or a private company, should these activities be contracted out to the latter or should there be

a build-operate-transfer arrangement between the municipal government and a private company. The revenues from the user charges shall be used for financing the MOC of the ECOSWAM service only. The Tuba municipal government wanted to know which of the following options it could afford to provide to its constituents:

Table 7: Options or Scenarios under Consideration by the Tuba Government

ECOSWAM Attributes	Base Case (Reference)	Scenario 1	Scenario 2	Scenario 3
C, Collector of Waste and Collection Vehicle	Barangay Workers with hired vehicle	Municipal workers with Garbage Truck	Municipal workers with Garbage Truck	Municipal workers with Garbage Truck
WTL, WS or Waste segregation	Waste segregation required;	Waste segregation required;	Waste segregation not required;	Waste segregation not required;
F, Frequency of waste collection in a week	Once	Once	Once	Twice

The researchers calculated the costs in consultation with the Tuba local government, SWM officials of neighboring local governments, SWM experts and the SWM plans of similar LGUs. The costs were divided into three stages: (1) waste segregation and reduction, (2) collection and transport and (3) waste disposal operations and management in a sanitary landfill.

The cost estimates provide a "snapshot" of the initial years that the ECOSWAM service shall be provided. Yearly costs are expected to increase with an increase in inflation, in the growth rate of the population, the local economy of Tuba and its waste generation and the wear and tear of SWM equipment, vehicles and facilities.

3.6. Funding Gap

The researchers estimated the funding gap or the difference between the marginal revenues (MR) and the marginal costs (MC) per year per scenario. This is the amount that the Tuba municipal government will have to subsidize in the provision of the ECOSWAM service. The estimates of the funding gap only provide a static picture of the SWM continuum. It is expected that unless the garbage fees are increased after some years, and given that the costs of the ECOSWAM service rise each year, then the funding gap will widen.

4.0 PROFILE OF THE RESPONDENTS

4.1 Environmental Knowledge, Attitudes and Perceptions (EKAP) and Practices

The households and business establishment ranked improper garbage disposal as the first and most important environmental problem that Tuba needs to address; followed by difficult access to clean drinking water and water pollution in rivers. Fifty two percent of the households and 59 percent of the business establishments have no prior knowledge of the Ecological Solid Waste Management Act or RA 9003.

Almost 50 percent of the households and 64 percent of the business establishments were aware of municipal and barangay ordinances on solid waste management.

Responses in a Likert scale on EKAP showed that majority of the respondents agree and strongly agree on the following:

Table 8: Environmental Knowledge, Attitudes and Perceptions (EKAP) of the Respondents

Statement	Households	Business
a. Our barangay is getting congested.	99%	95%
b. Our barangay does not have any space that will serve as a garbage dumpsite.	80%	87%
c. Open dumping and burning are rampant in our barangay.	76%	89%
d. Proper garbage collection will make our environment healthier.	99%	99%
e. Waste segregation will help reduce the volume of waste in our community.	99%	99%
f. Segregation of waste is easy to do. This implies that many of the respondents are already practicing waste segregation.	99%	95%
g. Waste management begins in our household.	98%	
h. My business establishment needs to improve its SWM		96%
i. Our barangay should have its own solid waste management plan, program, budget and ordinance.	99%	99%
j. The municipal government needs to enact a new ordinance on solid waste management and allot more budget for this.	96%	99%

In the three Tuba barangays, each household can generate PhP 21 (USD 0.40) to PhP 69 (USD 1.29) per month from the sales of recyclables. Each business establishment can earn PhP 33 (USD 0.63) per month from the sales of recyclables. Hence, the sales of recyclables will reduce the amount of waste to be brought to the disposal site and at the same time enable Tuba people to earn income which they could use to pay their garbage fees.

4.2 Reactions to Garbage Fees

Eighty-one percent of the households and business establishments agree and strongly agree that garbage fees should be collected. Forty-nine percent of the households and 67 percent of the business establishments agree and strongly agree that those who produce more waste should pay more garbage fees. About 55 percent of the households and business establishments disagree and strongly disagree that those with higher incomes and more assets should pay more garbage fees. The common reason for this is that they want the fees to be uniform.

4.3 Acceptance of the Contingent Valuation Scenario (Choice Sets)

Ninety three percent of the households and 88 percent of the business establishments believe that the Tuba municipal government will be able to implement the ECOSWAM service within three years after the survey. Eighty percent of the households and 88 percent of the business establishments agree that a garbage user fee is a good way to finance the ECOSWAM service. Most of the households said that they could reduce their expenditures for recreation in order to pay their garbage fees. The business establishments said that if they have a fixed budget every month and they are to pay a garbage user fee, they would reduce their expenses on (1) traveling, transportation and gasoline costs (2) electricity and water bills and (3) savings.

Both groups were in favor of a proposal that if they are not able to pay their garbage fees, a household member or employee of a business establishment shall render community service for one day for the month that his household was not able to pay their garbage fees. Community service includes helping in barangay clean up and beautification programs and other projects. About 76 percent of the respondents were in favor of this proposal. Other suggestions were to add a penalty or surcharge to their garbage fees for the next month, and that the barangay captain should not issue the business establishment or its owner a barangay clearance. (A barangay clearance is a requirement for a business permit).

Aside from paying their garbage fee, the business establishments were willing to help the ECOSWAM program through: proper solid waste management; volunteering to help clean the barangay; and donations in cash or in kind to the ECOSWAM program.

When asked what external sources of funds the Tuba municipal government should tap in order to finance its ECOSWAM program, the top three answers were: (1) ask for financial assistance from the provincial and national governments; (2) ask for assistance from the Congressman and (3) ask for donations from private companies.

5.0 WILLINGNESS-TO-PAY CHOICE MODEL RESULTS

5.1 Response to Choice Sets According to Price Levels

Most of the household responses favored the base option (lowest price) in the pilot study and second pre-test. This situation changed in the third pre-test and final survey, when the researchers (a) removed the label of "base" case and presented this as option 2, instead of option 1, (b) added more pictures to the choice sets and (c) highlighted the differences between the two options in each choice set. Most of the business establishments chose the base case of PhP 8 per sack of waste. However, they preferred the alternative option in some choice sets.

Figure 3: ***Households' Responses to Choice Sets***

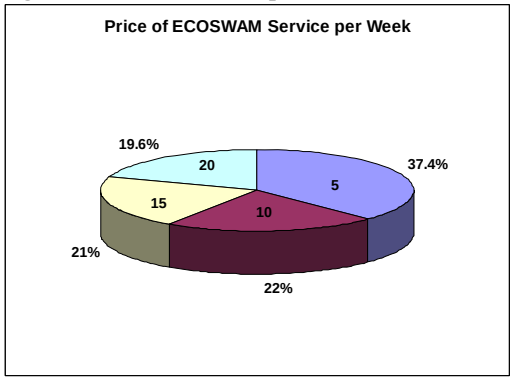
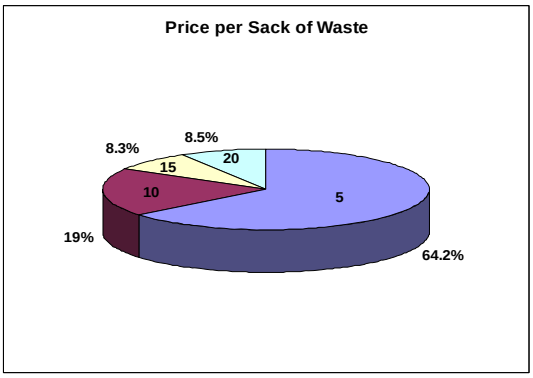


Figure 4: ***Business Establishments' Responses to Choice Sets***



5.2. Choice Models

5.2.1 Households

Model 1 consists of the ECOSWAM attributes only. Model 2 includes the attributes interacted with 15 household variables. In model 1, the ECOSWAM attributes of frequency of waste collection per week (F) and the price of the user fee (P) significantly influenced the utility of the respondents. The positive coefficient of the frequency attribute means that the option with the next level (i.e. waste collection is twice a week) increases the utility of the household. The price attribute's coefficient is negative, which means the household's utility is decreased with an option having a higher price. This is consistent with economic theory.

In model 2, the variables that significantly influenced the choice or the utility of the households were: their EKAP, whether or not they practice recycling, the quantity of their biodegradable waste, the number of years of formal schooling of the household head and household income.

Table 9: Choice Models of the Households (Base Case)

	Model 1 (Attributes only)			Model 2 (Attributes interacted with socio-economic characteristics)		
Variable	Coefficient	b/St.Er.	Sig	Coefficient	b/St.Er.	Sig
C	0.0903	1.487		-0.0814	-0.854	
F	0.1812	2.732	**	-0.0318	-0.253	
P	-0.0430	-5.326	***	-0.1138	-2.132	*
WTL1	-0.0156	-0.200		0.0316	0.038	
WTL2	-0.0971	-1.288		1.2369	1.417	
ASCH1	0.2439	2.590	**			
EKAPxWTL1				0.4219E-02	0.022	
EKAPxWTL2				-0.1857	-0.947	
EKAxP				0.0288	2.358	*
RECxWTL1				-0.1286	-0.731	
RECxWTL2				-0.5293	-2.304	*
COMxTL1				0.1038	0.901	
COMxTL2				-0.2108	-1.377	
QBxF				0.0615	2.060	*
QNRxF				0.9136E-02	0.671	
QBxP				-0.4647E-02	-2.011	*
QNRxP				-0.8418E-03	-0.760	
IBxWTL1				-0.1069	-0.772	
IBxWTL2				0.0210	0.111	
EDUCxP				-0.3404E-02	-3.680	***
GENDERxP				-0.3558E-02	-0.480	
HHSIZExP				0.4929E-03	0.355	
DECIxP				0.1786E-03	1.040	
HHINCxP				0.2194E-06	0.390	
HHINCxC				0.1475E-04	2.050	*
HOUSExP				-0.9791E-02	-1.264	
ROOMSxP				0.3669E-03	0.150	
ASSETSxP				0.9253E-03	0.588	
LANDxP				-0.6895E-02	-0.604	
LANDxF				-0.0256	-0.190	
ASCH2				0.2181	2.273	*
No of observations	4,832			4,832		
R2	0.052			0.062		
Adj R2	0.052			0.062		

* Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level

Note:
Attribute: C-waste collector; F-frequency of waste collection; P-price of ECOSWAM service or user fee; WTL-waste segregation, type/location of collector and mode of payment; ASCH-alternative specific constant for households

When a household practices recycling, the attribute of waste segregation, type or location of collection and mode of payment level two (WTL2) becomes significant. This means, that, conditional on modified pick-up, such household's utility is decreased when the ECOSWAM service does not require waste segregation.

The greater the quantity of biodegradable waste a household generates, the more likely it is to choose an option where waste collection is more frequent. This is true for households that do not feed their biodegradable waste to animals, those who do not do composting and those with little land to bury these wastes in.

The greater the quantity of biodegradable waste that a household generates, the more price sensitive it is. It is more likely to choose an option with a lower garbage fee or price. Households that dispose of their biodegradable waste by feeding these to animals or by composting produce a less waste for collection and hence, prefer to pay lower garbage fees.

Respondents with more years of schooling or those with higher educational attainment are more price sensitive. They are not more likely to choose an option with a higher price. However, the greater the EKAP score of the respondent, the more likely he is to choose the ECOSWAM option with a higher garbage fee or price. Hence it is not the number of years of formal schooling per se that make a respondent prefer a better ECOSWAM option with a higher price but rather his EKAP score.

At "zero" level of income, the attribute of waste collector and collection vehicle, C, is not significant. As the household income increases, the household's utility is increased when it chooses the option where the municipal truck and workers collect the household's waste rather than the barangay workers with a hired jeepney.

5.2.2 Business Establishments

Model 1 shows that the ECOSWAM attributes of waste collector and collection vehicle (C), frequency of waste collection (F) and price (P) significantly influence the business establishment's choice of an ECOSWAM service. The positive coefficient of C shows that a business establishment's utility is increased when it chooses an option where waste is collected by municipal workers with a municipal garbage truck. This is because a truck has a larger capacity and is easily recognizable as the waste collection vehicle as opposed to a rented jeepney. The business establishments also expect a more reliable ECOSWAM service with a garbage truck because there may be times that the jeepney hired to collect the waste would not be available.

The positive coefficient of collection frequency shows that the option where waste is collected more frequently increases the utility of the business establishment. Some business establishments are concerned with rotting garbage and sanitation so they prefer garbage collection to be more frequent. The negative coefficient of the price attribute shows that business establishments are price sensitive. An option with a higher price decreases their utility.

Model 2 shows that the price attribute also significantly influence the business establishment's utility. The other significant variables are the EKAP score (EKAP x P), whether or not it practices composting (COMP x WS), its quantity of biodegradable waste (QB x P), indigenous beliefs on solid waste management (IB x WS), capitalization (CAP x P), net income (NETINC x C), floor area (FLRA x WS), and the distance of the establishment from the road (RD x WS).

The coefficient of the Environmental Knowledge Attitudes and Perceptions score interacted with price is significant and positive. This shows that business establishments with higher environmental awareness are more likely to support increasing levels of ECOSWAM services (reflected in options with higher prices).

Business establishments that practice composting of their biodegradable waste are more likely to choose an ECOSWAM option that does not require waste to be segregated. Business establishments that generate a greater quantity of biodegradable waste (especially those that do not practice composting) are more sensitive to price. Business establishments that have more indigenous cultural beliefs and practices on solid waste management are more inclined to choose the alternative option where waste segregation is not required. Business establishments with wider floor areas are more likely to choose an option where waste segregation is not required. One reason is their lack of time to segregate waste. Business establishments nearer the main road are more likely to choose an option where segregation is not required. A common reason for this is lack of space.

Business establishments with greater capitalization are more price sensitive. Only 57 percent of the business establishments agreed or strongly agreed with the statement that those with higher capital and assets should pay higher garbage fees.

At zero net income, the collector of waste and collection vehicle (C) does not significantly influence the choice of the business establishment. However, as the net income of a business establishment increases, the C attribute becomes significant to its choice of an ECOSWAM service option. As such, it is more likely to choose an option with a higher level of service, i.e., the municipal garbage truck. When the owner or manager of the establishment is the sole-decision maker on the expenditure decisions of the establishment, he or she is less sensitive to the price of the ECOSWAM service.

Table 10. Choice Models of Business Establishments (Base Case)

Variables	Model 1 (Attributes only)			Model 2 (Attributes interacted with socio-economic characteristics)		
	Coefficient	b/St.Er.	Sig	Coefficient	b/St.Er.	Sig
C	0.3714	3.000	**	0.1071	0.616	
WS	0.1602	1.296		0.9916	0.883	
F	0.3876	3.131	**	0.2848	1.614	
P	-0.0895	-5.845	***	-0.3348	-2.343	*
ASCB1	0.4651	2.902	**			
EKAPxWS				-0.1972	-0.683	
EKAPxP				0.1014	3.788	***
RECxWS				0.0402	0.152	
COMPxWS				-0.4529	-2.378	*
QBxF				0.6766E-03	0.267	
QBxP				0.6764E-03	1.784	*
QNBxF				0.6876E-02	0.716	

Variables	Model 1 (Attributes only)			Model 2 (Attributes interacted with socio-economic characteristics)		
QNBxP				0.9050E-03	1.017	
IBxWS				0.6847	2.759	**
YRxC				0.0185	1.519	
WKxF				0.0180	1.107	
CAPxP				-0.2095	-2.420	*
NOWxP				0.6647E-03	0.297	
NETINCxP				0.6014E-06	0.365	
NETINCxC				0.2909E-04	2.051	*
DECxP				0.0419	1.745	*
LANDxWS				-0.5676E-05	-0.373	
LANDxP				-0.2006E-05	-1.352	
FLRAxWS				1.3101	3.424	***
RDxWS				-1.3092	-3.421	***
RDxF				0.4366E-03	0.244	
SWMExP				-0.1594E-05	-0.338	
ASCB2				0.4916	2.974	**
No of observations	1,200			1,200		
R^2	0.095			0.151		
Adj R^2	0.092			0.131		

* Significant at 10% level; ** Significant at 5% level; *** Significant at 1% level

Note:

Attribute: C-waste collector; F-frequency of waste collection; P-price of ECOSWAM service or user fee; WS-waste segregation; ASCB-alternative specific constant for business establishments.

5.3. Implicit Prices

Considering only the significant attributes, households are willing to pay an additional fee of PhP 4.21 per week or PhP 16.88 per month for an option wherein the frequency of garbage collection is twice a week. This amount is roughly equivalent to three-fourths kilo of rice. Business establishments are willing to pay PhP 4.15 more per sack of waste for an ECOSWAM service where the municipal workers with the garbage truck are the collectors of waste. They are also willing to pay an additional amount of PhP 4.33 per sack of waste for an ECOSWAM service where their waste is collected twice a week. Taken together, these amount to PhP 8.45 per sack. With an average waste generation of one sack per week or four sacks per month, this amounts to about PhP 34 per month or 1.2 liters of gasoline.

Table 11. Implicit Prices for Households (per week) and Business Establishments (per sack of waste), in Model 1

Non-market attribute	Households (per week)		Business Establishments (per sack)	
	PhP	USD	PhP	USD
C	2.1	0.04	4.15**	0.08
F	4.21**	0.08	4.33**	0.08
WTL1	0.36	0.01		
WTL2	2.26	0.04		
WS			1.79	0.03

** Significant at 5% level

Attributes: C-waste collector; F-frequency of waste collection; P-price of ECOSWAM service or user fee; WS-waste segregation; WTL-waste segregation, type/location of collector and mode of payment

1 USD = PhP 53.15 and 1 liters gasoline = PhP 29 (March 11, 2005).

6.0. ANALYSIS OF REVENUES, COSTS AND FUNDING GAP

6.1. Potential Annual Marginal Revenues from User Fees

Table 12 shows the potential annual marginal revenues from the user fees of 3,358 households and 300 business establishments to be initially covered by the ECOSWAM service. These indicate how much user fees people are willing to pay above the base case of PhP 20 per month per household and PhP 8 per sack for business establishments, for alternative scenarios 1, 2 and 3. These indicate how much the people value the ECOSWAM service options in terms of their attributes.

Potential annual revenues from the base case, using the assumed monthly fees of PhP 20 per household and PhP 32 per business establishment would amount to around PhP 921,120. However, as this is the reference point (base case), it is assumed that its revenues are zero. Marginal revenues from scenarios 1, 2 and 3 will amount to around PhP 1.2 million to PhP 1.9 million (USD 22000 to 36000).

Table 12 . Annual Marginal Revenues From Garbage or User Fees (Above Base Case)

Rate above the Base Case	Scenario 1	Scenario 2	Scenario 3
Household Rate, PhP per month	27	25	42
Household Rate, PhP per year	321	303	506
Sub-total, Households	1,076,651	1,018,177	1,697,741
Business Rate, PhP per month	34	41	58
Business Rate, PhP per year	407	493	701
Sub-total, Business Establishments	122,112	147,888	210,240
Total, Households + Business Establishments, PhP To move from base case to:	1,198,763	1,166,065	1,907,981
Total, Households + Business Establishments, USD	22,554	21,939	35,898
To move from	**Marginal Revenues, PhP**		
Scenario 1 to Scenario 2			(32,698)
Scenario 2 to Scenario 3			741,916
Scenario 1 to Scenario 3			709,218

6.2. Costs of ECOSWAM Options

The study estimated the total maintenance and operating costs (MOC) for the base case of the ECOSWAM service and three alternative scenarios or options (Table 13). The base case is that option that meets the minimum requirements of RA 9003. The alternatives have improved levels of the service. The revenues from the user charges shall only be used to finance the MOC of the ECOSWAM service. The study also estimated the marginal MOCs or how much it would cost the Tuba municipal government to move from the status quo (no ECOSWAM service, no user fees) to the base case and to the other alternatives (Table 14). The estimates included contractual labor since Tuba had reached its maximum allowed budget allotment for permanent

staff, i.e., it can no longer hire permanent staff, according to Tuba Mayor Baluda. The detailed cost estimates for the base case and the alternatives are in Appendix B.

Table 13. Annual Maintenance and Operating Costs (MOC) of the ECOSWAM Service Options

Stages	Base Case	Scenario 1	Scenario 2	Scenario 3
1: Waste Segregation and Reduction, PhP	239,030	239,030	491,494	595,894
2: Collection and Transport, PhP	4,906,287	1,853,895	3,168,751	3,401,221
3: Waste Disposal Operations and Management: Sanitary Landfill, PhP	1,363,287	1,363,287	1,561,535	1,784,683
Total Maintenance and Operating Costs				
PhP	6,508,604	3,456,212	5,221,780	5,781,798
USD	122,457	65,028	98,246	108,783
Cost per m^3				
PhP	1,959	1,040	679	752
USD	37	20	13	14
Cost per ton (1)				
PhP	6,465	3,433	2,240	2,480
USD	122	65	42	47
Cost per HH and BE per year				
PhP	1,779	945	1,428	1,580
USD	33	18	27	30
Cost per HH and BE per month				
PhP	148	79	119	132
USD	2.8	1.5	2.2	2.5

(1) Waste density is 300 kg per m^3; 1 USD = 53.15 (March 11, 2005)

For scenarios 1, 2 and 3, the assumption is that the Tuba LGU would purchase two dump trucks with a capacity of 6 m^3 each. These are capital costs and hence, not accounted for in the MOC calculations. Collection and transport costs comprise the bulk of the total MOC. Scenario1 has the least total MOC of about PhP 3.4 M per year followed by Scenario 2 at PhP 5.2 M and Scenario 3 with PhP 5.8 M.

With an estimated annual total volume of 3,322 m^3 of waste to be handled, the base case has the highest total MOC and unit costs. This finding is contrary to what was originally expected - that the base case would be the cheapest option. This was because many of the respondents did not seem to consider the haul distance to the disposal site in making their choices. The people thought that a small-scale type of service, e.g., barangay workers with a hired small vehicle like a jeepney would be the cheapest option. However, considering the limited capacity of the jeepney (1.5 m^3), the long distance for hauling the waste, and the amount of waste for collection, more jeepneys would be needed. About 2,215 jeepney trips making one trip per day at a rental rate of PhP 2,000 including the driver's daily wages, would amount to about PhP 4.4 million or USD 82,784 a year.

In Scenarios 2 and 3, where waste segregation is not required, the unit costs are lower because a greater volume of waste is handled. Most labor costs are fixed,

regardless of the volume of waste. With more wastes, the cost per unit volume of waste will decrease, although the total MOCs will increase. This is more pronounced when capital costs are included. This demonstrates the economies of scale in ECOSWAM services, especially in operating a sanitary landfill (SLF). On the other hand, disposing only residual wastes in a SLF will entail lesser MOCs , although the cost per unit volume of waste will increase. Disposing only residual wastes will lengthen the life of the SLF and will result in savings in terms of avoided costs of the construction of another SLF.

Numerous studies have demonstrated that solid waste disposal activities benefit from large and significant economies of scale: the larger the capacity of a given site, the lower the cost per ton of waste land filled. If these economies of scale exist, smaller local government units may not be able to exploit them solely because their smaller size would not justify the investment necessary to do so. However, a cluster of municipalities may be able to do it. Municipalities should be encouraged to exploit these scale economies (Laplante, 2003).

Table 14 shows the marginal costs that Tuba will incur in order to move from the base case and to shift from one scenario to another. Since the base case is the reference point, its costs shall be assumed to be zero. The lowest marginal cost will be incurred when Tuba moves from the base case to scenario 1.

Table 14. Annual Marginal Costs Of ECOSWAM Services

To Move From	**Marginal Costs, PhP**
Base Case to Scenario 1	3,456,212
Base Case to Scenario 2	5,221,780
Base Case to Scenario 3	5,781,798
Scenario 1 to Scenario 2	1,765,568
Scenario 2 to Scenario 3	560,018
Scenario 1 to Scenario 3	2,325,586

Table 15 shows the costs per stage of the ECOSWAM services. The costs of stage 2 or the collection and transport of wastes comprise an average of 62 percent of the total costs. This is consistent with the findings of the DENR EMB and Cointreau (1994) that collection costs account for about 40 to 80 percent of the total costs. Hence, should LGUs want to reduce costs in ECOSWAM services, they need to reduce waste collection and transport costs.

Table 15. Cost per Stage of the ECOSWAM Service as a Percentage of the MOCs

Stages	Base Case	Scenario 1	Scenario 2	Scenario 3	Average
Stage 1 – Waste Segregation & Reduction	4%	7%	9%	10%	8%
Stage 2 – Collection and Transport	75%	54%	61%	59%	62%
Stage 3 – Disposal and Sanitary Landfill Management	21%	39%	30%	31%	30.%
Total	100%	100%	100%	100%	100%

The study compared Tuba's estimated maintenance and operating costs with those of other LGUs like Baguio City, its nearest neighboring LGU; with Sibulan, of similar population size; with Olongapo, a model for cost recovery; with San Fernando City, La Union province, another model and neighbor, but in a lowland area and with Muñoz City, with a proposed sanitary landfill (SLF). The total costs of a SLF are ten times greater than those of an open dump, in the case of Muñoz City. The WB-SWEEP study (1998) and Sumalde's study (EEPSEA, 2005) found lower costs for SWM services because the LGUs they studied used either open dumps or controlled dumps. The total MOCs of Metro Manila LGUs are higher because of greater waste volumes and high rates charged by private contractors. With an average coverage area of 98 percent of the total population, their average per capita cost is PhP 393; annual SWM expenses are PhP 3.4 million and cost per ton is PhP 1,695 (ADB, 2003). The estimated costs for Tuba are for a sanitary landfill and the MOCs with contractual labor. If the capital costs of Tuba are added, the cost figures will increase. Its costs per ton are high because of the small volume of waste that it will handle, initially. This shows that there are economies of scale in ECOSWAM, i.e., the greater the quantity of wastes handled, the lower the unit costs will be. The cost estimates for Tuba in this study are also consistent with Cointreau's work (2000).

Table 16. Comparative Costs of ECOSWAM Services Across LGUs

LGU		Population	Covered Population % of Total	Tons Per Day	Total Costs (PhP `000)	Costs Per Ton, PhP	Costs Per HH Served, PhP
Baguio City (1) (big LGU, open dump)		418,972	98	233	23,649	278	572
Sibulan City (1) (small LGU, open dump)		37,523	87	5	515	282	79
Olongapo City (1) (SWAPP LGU, semi-controlled dump)		229,839	100	65	22,500	948	522
San Fernando, La Union (1) (SWAPP LGU, semi-controlled dump)		102,082	73	48	15,216	867	1,014
Munoz City, Nueva Ecija (2)							
Open dump (2002)		68,611	31	12	1,100	258	260
Proposed SLF (costs by 2007) (3)		90,693	100	22	20,116	2,438	1,100
Tuba (4) (proposed SLF)	Base Case	39,525	42 % of HH and 41 % of BE	3	6,509	6,465	1,779
	Scenario 1			3	3,456	3,433	945
	Scenario 2			6	5,222	2,240	1,428
	Scenario 3			6	5,782	2,480	1,580

(1)Total costs: Up-front Costs (Capital Costs), Maintenance and Operating Costs and Back- end Costs (Closure or Decommissioning of Disposal Site after its useful life), SWAPP – Solid Waste Association of the Philippines. Source: Sumalde, EEPSEA 2005

(2) Source: ECOSWAM Plan of Munoz City, Nueva Ecija with assistance from the DENR-NSWMC and JBIC

(3) Interest rate is 6 percent

(4) Maintenance and Operating Costs with contractual labor

When comparing costs among LGUs, it is important to note that except for Tuba, SWM costs of the LGUs in Table 16 are total costs, i.e., capital, maintenance and operating costs and back-end costs. In some LGUs, labor costs for permanent personnel are not included in the SWM budget, but are placed under the budget of different departments. Labor costs comprise a substantial proportion of the SWM budget (Bennagen, 2003 and Sumalde, 2005). Furthermore, unit costs for SWM do not reflect the attributes or quality of the service, such as frequency of waste collection; the type of final disposal site, technology and local conditions. Hence, this study attempted to determine how people valued the benefits of the ECOSWAM waste service options based on their attributes. Two LGUs may have the same tonnage of waste or the same population size, but if waste is collected more frequently in one LGU than the other, then the costs of the first LGU will be higher. If the first LGU uses a sanitary landfill, while the second LGU uses an open dump, then the costs of the first LGU will be greater. According to the DENR-NSWMC (2004), direct comparisons between the budgets and expenditures between LGUs are difficult to carry out because the responsibility for solid waste management in LGUs falls in different offices so costs may not be correctly or fully accounted.

6.3. Funding Gap

Table 17 shows the annual marginal revenues from ECOSWAM user fees vis-à-vis the marginal maintenance and operating costs (MOC) and the marginal funding gap and the cost recovery from the user fees. To move from the base case to the scenario with the lowest funding gap of PhP 2.2 M, Tuba will need to adopt scenario 1. This is the option wherein municipal workers with a garbage truck collect segregated waste once a week. It also has the highest cost recovery, i.e., the user fees would cover 35 percent of the costs of the service.

In terms of moving from one alternative scenario to another, moving from scenario 1 to scenario 2 would not be a good move since it will entail losses and negative cost recovery. Moving from scenario 2 to 3 will be a good move since the marginal revenues of shifting from once a week to twice a week waste collection will be greater than the marginal costs and thus, there will be no funding gap.

Table No 17. Funding Gap: Marginal Costs vs. Marginal Revenues

To move from	**Marginal Revenues, MR** (PhP)	**Marginal Costs, MC** (PhP)	**Marginal Gap = MR-MC** (PhP)	**% Cost Recovery**
Base Case to Scenario 1	1,198,763	3,456,212	(2,257,449)	35%
Base Case to Scenario 2	1,166,065	5,221,780	(4,055,715)	22%
Base Case to Scenario 3	1,907,981	5,781,798	(3,873,817)	33%
Scenario 1 to Scenario 2	(32,698)	1,765,568	(1,798,266)	-2%
Scenario 2 to Scenario 3	741,916	560,018	181,898	132%
Scenario 1 to Scenario 3	709,218	2,325,586	(1,616,368)	30%

7.0 SUMMARY AND CONCLUSIONS

The study used the stated preference choice modeling method to assess the preferences of households and business establishments for ecological solid waste management services (waste collection, transport and disposal). Almost all of the households and business establishments interviewed believed that the Tuba municipal government will be able to provide the ECOSWAM service within three years after the survey. They also agreed that a garbage or user fee is a good way to finance the service. They were willing to reduce their expenditures for recreation, transportation and electricity in order to pay their garbage fees.

The frequency of waste collection, price of the service or user fee and collector of waste significantly influenced the choice of the people regarding ECOSWAM services. The following socio-economic characteristics significantly influenced the choice of households and business establishments: environmental knowledge, attitudes and perceptions (EKAP); income; quantity of biodegradable waste; solid waste management practices like recycling and composting; educational attainment of household head; indigenous SWM beliefs; capitalization; and being a sole decision-maker on expenditures. The study's findings on the determinants of people's choices of ECOSWAM services are consistent with those of Jamal's (EEPSEA 2002), Wertz (1974) as cited by Jenkins (1993), Gottinger (1991), Bennagen (EEPSEA 2002) and Schubeler (1996).

The WTP values for ECOSWAM services derived from the choice modeling (CM) used in this study are slightly higher than the average WTP values of urbanized cities like Iloilo and Naga, Philippines, taken from the WB-SWEEP study (1998) that used the closed iterative contingent valuation method (CVM). The slight difference could be due to inflation and the devaluation of the peso. This shows that people from suburban municipalities are willing to pay almost the same user fees for ECOSWAM services as people from urban and wealthier cities. This also shows that the estimates from the CM and CVM methods are fairly similar. Thus, CM can be adopted to determine the demand for ECOSWAM services in other local government units. Some "tailor-fitting" is needed per LGU, such as studying the existing SWM system in order to design the attributes and levels of the ECOSWAM services. This is one of the strengths of the attribute-based methods.

The costs of ECOSWAM services for small municipalities like Tuba do not differ much from those of big cities. Tuba's unit costs per ton and per household served are greater than those of bigger and more densely populated cities. Significant economies of scale demonstrate that the overall cost per ton of waste disposal progressively decreases as the capacity of the sanitary landfill site increases and the daily volume of waste handled increases (DENR-NSWMC Waste Bulletin, 2001).

While the people of Tuba ranked improper solid waste disposal as the top environmental problem, they were willing to pay user fees that could cover only about 22 to 35 percent of the costs of ECOSWAM services. Hence, the Tuba

municipal government would have to allocate at least PhP 2 million yearly, in order to subsidize the maintenance and operating costs of these services. This implies that it will have to slice off as much as 25 percent from its development fund. Its development fund comprises 20 percent of its total budget or internal revenue allotment. If no user fees are collected, the Tuba municipal government will have to spend about 40 percent of its development fund to provide ECOSWAM services. Without revenues from user fees, the ECOSWAM services would cost Tuba about eight to 15 percent of its total budget. This implies that it will have to make trade-offs between ECOSWAM services and other social services such as education, health and basic infrastructure.

Including the capital costs in the calculations will magnify the funding gap. Hence, there is a need for the Tuba municipal government to explore other additional financing options, besides user fees, for its ECOSWAM services. These will include creating markets for the sale of recyclables, greater private sector participation, either through public-private partnerships or contracting out, co-production and inter-LGU arrangements for common ECOSWAM facilities and services. Business establishments interviewed were more open to the idea of contracting out the ECOSWAM services to the private sector for the significant operational and financial improvements that it can provide.

8.0. POLICY IMPLICATIONS AND STRATEGIC OPTIONS

Based on the findings of the study, the following policy implications and strategic options are offered for Tuba, Benguet and similar local government units:

a. For the Tuba municipal government, the ECOSWAM option with the least cost and lowest funding gap is Scenario 1. This is the service wherein residual waste collection is done by a garbage truck once a week. The type or location of waste collection shall be through the curbside method combined with collection points in areas where households and business establishments are far apart or are located in steep areas. For those areas where buildings are close together and along the road, modified pick-up of waste sacks can be done. The waste collectors shall provide the empty waste sacks to replace those that they shall collect from the households and business establishments.

b. Increased investments in public environmental information, education and communication programs will enhance the environmental knowledge, attitudes, and perceptions (EKAP) and SWM practices of people and will contribute to the reduction of the volume of waste generated and disposed of and encourage them to be willing-to-pay more for higher levels of ECOSWAM services.

c. Since the quantity of biodegradable wastes significantly affects people’s choices, programs that promote the reduction or re-use of these wastes need to be encouraged. Examples are composting and neighborhood-level collection of biodegradable wastes by those that have animals to feed.

d. The funding gap could be addressed by increasing the revenues from user fees, by decreasing costs and by looking beyond LGU resources. Other sources of revenue accruable to the municipality such as mining revenues, in the case of Tuba, are currently being studied, as a means to support ECOSWAM services. Other external sources of funds include those from the provincial government, the congressman's Countryside Development Fund and private sector contributions. Furthermore, as the LGU with a ready site for a sanitary landfill (SLF), Tuba would be able to take the lead in organizing a cluster with neighboring LGUs (that are also in a dilemma looking for a disposal site) in order to jointly finance the construction, maintenance and operations of a common SLF. As it could be the host of the SLF, Tuba will have to set its terms and conditions regarding the development, management and use of the disposal site. If Tuba can finance the construction of a SLF with its own resources or obtain external funding such as a loan for this, then it can recover its costs by collecting user fees from the LGUs that use the SLF.

e. There is also a need for the national government, particularly the inter-sectoral National Solid Waste Management Commission (NSWMC), headed by the Department of Environment and Natural Resources to revisit RA 9003. As gleaned from this study, many LGUs find it hard to comply, financially and technically with the ambitious targets set by RA 9003. In particular, the commission needs to review the provisions on the planning and programming policy for SWM, clustering of common SWM problems, establishment and operations of sanitary landfills, the financing of solid waste management and cost recovery mechanisms. There is a need for more detailed guidelines for clustering of LGUs for ECOSWAM services as well as the need to set up a pilot or model cluster that could be replicated in other LGUs. Piloting the cluster concept for SWM in the LGUs of Baguio-La-Trinidad-Itogon-Sablan-Tuba (BLIST), could provide a challenging, but worthwhile project for the commission to undertake or endorse.

f. The NSWMC and the Investment Coordinating Committee of the National Economic and Development Authority also need to review laws regarding cost-sharing mechanisms between the national and local governments for environmental and social projects, and enable solid waste management projects of LGUs to be eligible to receive support such as matching grants from the national government.

g. Areas for future research using CM in solid waste management could include: (i) considering the distance from the community to the final disposal site as a determinant of the WTP for ECOSWAM services and (ii) differential pricing or price discrimination among areas or villages in terms of their attributes, e.g., income class, location and accessibility.

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Philippine Laws

1. Republic Act No. 9003 or the Ecological Solid Waste Management Act of 2000 and its Implementing Rules and Regulations, DENR Administrative Order No. 2001-34.

2. Republic Act No. 7160 or the 1991 Local Government Code and its Implementing Rules and Regulations.

3. Presidential Decree 856 or the Sanitation Code.

APPENDIX A

List of Enumerators in the Study

The enumerators listed below received training and gained experience in the administration of questionnaires that use the choice modeling method (CM). They are highly recommended as enumerators for future surveys. Researchers who plan to use CM in the Philippines and who would like to recruit enumerators may contact the following persons through the Tuba Rural Health Unit (RHU) or at their contact addresses below.

Name	**Address**	**Contact Number** Area Code (63)
1. Emilia S. Aliteg*	Topinao, Poblacion, Tuba, Benguet	09273727965
2. Liala B. Calgo*	Topinao, Poblacion, Tuba, Benguet	09183633253
3. Irene G. Catalino	Topinao, Poblacion, Tuba, Benguet	
4. Beverly P. Liu*	Bodiwan,Poblacion.Tuba, Benguet	09213521475
5. Leonarda C. Miranda*	Bumasgao, Poblacion, Tuba, Benguet	
6. Norma Esteban	Poblacion.Tuba, Benguet	09208231771
7. Vergilia Castillar	Poblacion.Tuba, Benguet	09194529224
8. Rachael Ambros	Poblacion.Tuba, Benguet	09193911102
9. Nenita Lagman	Poblacion.Tuba, Benguet	
10. Maricel D. Atolgid*	Km. 6 Asin Rd. Tadiangan,Tuba, Benguet	
11. Elsa J. Bunnol*	Km. 6 Asin Rd. Tadiangan,Tuba, Benguet	074-447 5117 0920873391
12. Helen Bunnol	Km. 6 Asin Rd. Tadiangan,Tuba, Benguet	09206301718
13. Juanita G. Langaoen	Yagyagan,Tadiangan,Tuba, Benguet	09182783860
14. Fernando I. Onnon*	Km. 6 Asin Rd. Tadiangan,Tuba, Benguet	09214275938
15. Rizalina B. Tomas*	Km. 6 Asin Rd. Tadiangan,Tuba, Benguet	09183165635
16. Brenda Bito	Pacac, Tadiangan, Tuba, Benguet	09186227201
17. Jovencia Patras*	Tadiangan, Tuba, Benguet	09173796482
18. Jennifer O. Emock	Tadiangan, Tuba, Benguet	09204617017
19. Corazon S. del Val*	Sinco, Tadiangan, Tuba, Benguet	09173323176
20. Nora Bacbac	Camp 4, Tuba, Benguet	
21. Delia Baban*	Camp 6, Tuba, Benguet	09194366715
22. Gloria Ognayon	Camp 4, Tuba, Benguet	
23. Angela Seriosa*	Camp 6, Tuba, Benguet	09187196312

24. Milagros Esteban*	Camp 6, Tuba, Benguet	
25. Marlene Luaña	Camp 6, Tuba, Benguet	09215250412
26. Imelda L. Lawagan	Camp 6, Tuba, Benguet	

* Participated in both the surveys of households and business establishments.

APPENDIX B

Annual Maintenance and Operating Costs

General Assumptions:

1. Unless specified, unit cost is per year.
2. The Tuba LGU shall provide each household and business establishment with one used rice sack per quarter to serve as a waste container.
3. In developed countries, government usually spends USD 1 to 1.50 per household per year for SWM IEC programs (Kreith, 1994).
4. Salaries and wages include 13th month pay or bonus.
5. Workers paid on a daily basis. Minimum daily wage is PhP 200. Sorters work in the afternoon when the waste is brought to the disposal site – half day's work. Additional sorters shall be hired on a daily basis.
6. One trip, i.e., from garage to collection route to disposal site and back to garage takes one day.
7. Contract for placing of soil or earth cover, includes excavation, loading, hauling, dumping, spreading and compaction of soil.
8. Pollutant abatement costs or costs inherent in the operation of a sanitary landfill include sampling and analysis of ground water, leachate collection, treatment and disposal and the regulatory fees and permits for these.
9. USD 1= PhP 53.15 (March 11, 2005)

Base Scenario:

Waste Collector and Collection Vehicle	Barangay Workers with Hired Vehicle (jeep = 1.5 m^3)
Waste Segregation	Once a week
Waste Segregation	Required: Only residuals go to disposal site
Type/Location and Mode of Payment	Modified pick-up (along the road), waste collection points; pay garbage fees to the barangay treasurer

Stage 1: Waste Segregation and Reduction

Cost Items	Units	Unit Cost*		Total
1. Supplies : used rice sacks				
Households (HH)	3358	5	per sack	16,790
Business Establishments (BE)	300	5	per sack	1,500
2. Information, Education and				
Communication Programs	3358	30	per HH & BE	100,740
3. Barangay MRF Maintenance & Operations	5	24,000	per brgy	120,000
Sub-total				239,030

Stage 2: Collection and Transport

No. of working days per week	4			
No. of collection routes	4			
No. of shifts per day	1			
Ave working hours per shift	8			
Ave residual waste collected per week, cu m	63.71			
Total Residual waste collected per year, cu.m.	3,322	=	1,007	tons

Cost Items	Units	Unit Cost*		Total
1. Salaries and wages				
Foreman, Salary Grade (SG) 15	1	164,671	per person	164,671
Drivers, SG 4				0
Laborers, SG 3	4	58,904	per person	235,616
2. Electricity and Water	12	1,000	per mo	12,000
3. Rental of collection vehicle	2215	2,000	per vehicle/day	4,430,000
4. Fuel, oil, tires, spare parts				0
5. Vehicle repair and maintenance				0
6. Building maintenance	12	2,000	per mo	24,000
7. Supplies and materials	12	1,500	per mo	24,000
8. Uniforms, protective gear	4	1,000		4,000
9. Communications	12	1,000	per mo	12,000
Sub-total				4,906,287

Stage 3: Waste Disposal Operations and Management: Sanitary Landfill

Cost Items	Units	Unit Cost*		Total
1.Salaries and wages				
Foreman, SG 15	1	164,671	per person	164,671
Laborers, including Flagman, SG 3 (1)	4	58,904	per person	235,616
Security Services	12	12,000	per mo	144,000
2. Placing of soil/earth cover	12	25,000	per mo	300,000
3. Electricity and Water	12	2,000	per mo	24,000
4. Road Maintenance				50,000
5. Building maintenance	12	2,000	per mo	24,000
6. Supplies and materials	12	1,500	per mo	24,000
7. Uniforms, protective gear	5	1,000	per person	5,000
8. Communications	12	1,000	per mo	12,000
9. Sampling and Analysis of Groundwater	4	15,000	per qtr	60,000
10. Leachate collection, treatment and				300,000
disposal				
11. Disposable Field Equipment				10,000
12. Regulatory fees/permits				10,000
(includes fees for leachate treatment)				
Sub-total				1,363,287
TOTAL, PhP				**6,508,604**
USD				**122,457**
Cost Per cu.m.				
PhP				**1,959.13**
USD				**36.86**
Cost Per Ton				
PhP				**6,465.13**
USD				**121.64**

Cost Per HH & BE Per Year				
PhP				**1,779.28**
USD				**33.48**
Cost Per HH & BE Per Month				
PhP				**148.27**
USD				**2.79**

Scenario 1

Waste Collector and Collection Vehicle	Municipal Workers with 6 m^3 Garbage Truck (2 units to be purchased)
Waste Segregation at Source	Required
Collection Frequency	Once a week
Type/Location and Mode of Payment	Modified pick-up (along the road), waste collection points; Pay garbage fees to the barangay treasurer

Stage 1: Waste Segregation and Reduction				
Cost Items	Units	Unit Cost*		Total
1. Supplies : used rice sacks				
Households (HH)	3358	5	per sack	16,790.00
Business Establishments (BE)	300	5	per sack	1,500.00
2. Information, Education and				
Communication Programs	3358	30	per HH & BE	100,740.00
3. Barangay MRF Maintenance & Operations	5	24,000	per brgy	120,000.00
Sub-total				239,030.00

Stage 2: Collection and Transport				
No. of working days per week	4			
No. of collection routes	4	(1 day per route)		
No. of shifts per day	1			
Ave working hours per shift	8			
Ave residual waste collected per week, cu m	63.71			
Total Residual waste collected per year, cu.m.	3,322	=	1,007	tons

Cost Items	Units	Unit Cost*		Total
1. Salaries and wages				
Foreman, Salary Grade (SG) 15	1	164,671	per person	164,671
Drivers, SG 4	2	58,722	per person	117,444
Laborers, SG 3	4	58,904	per person	235,616
2. Electricity and Water	12	2,500	per mo	30,000
3. Rental of collection vehicle				0
4. Fuel, oil, tires, spare parts	554	1,716	per trip	1,070,664
5. Vehicle repair and maintenance				162,500
6. Building maintenance	12	2,000	per mo	24,000
7. Supplies and materials	12	1,500	per mo	24,000

8. Uniforms, protective gear	7	1,000	per person/yr	7,000
9. Communications	12	1,500	per mo	18,000
Sub-total				1,853,895

Stage 3: Waste Disposal Operations and Management: Sanitary Landfill				
Cost Items	Units	Unit Cost*		Total
1.Salaries and wages				
Foreman, SG 15	1	164,671	per person	164,671
Laborers, including Flagman, SG 3	4	58,904	per person	235,616
Security Services	12	12,000	per mo	144,000
2. Placing of soil/earth cover	12	25,000	per mo	300,000
3. Electricity and Water	12	2,000	per mo	24,000
4. Road Maintenance				50,000
5. Building maintenance	12	2,000	per mo	24,000
6. Supplies and materials	12	1,500	per mo	24,000
7. Uniforms, protective gear	5	1,000	per person/yr	5,000
8. Communications	12	1,000	per mo	12,000
9. Sampling and Analysis of Groundwater	4	15,000	per qtr	60,000
10. Leachate collection, treatment and				300,000
disposal				
11. Disposable Field Equipment				10,000
12. Regulatory fees/permits				10,000
(includes fees for leachate treatment)				
Sub-total				1,363,287
TOTAL, PhP				**3,456,212**
TOTAL, USD				**65,028**
Cost Per cu.m.				
PhP				**1,040.34**
USD				**19.57**
Cost Per Ton				
PhP				**3,433.13**
USD				**64.59**
Cost Per HH & BE				
PhP				**944.84**
USD				**17.78**
Cost Per HH & BE Per Month				
PhP				**78.74**
USD				**1.48**

Scenario 2

Waste Collector and Collection Vehicle	Municipal Workers with 6 m^3 Garbage Truck
Waste Segregation at Source	Not Required but biodegradables and recyclables shall be brought to the municipal MRF near disposal site
Collection Frequency	Once a week
Type/Location and Mode of Payment	Modified pick-up (along the road) and collection points Modified pick-up (along the road) and collection point and pay to the barangay treasurer

Stage 1: Waste Segregation and Reduction

Cost Items	Units	Unit Cost*		Total
1. Supplies : used rice sacks				
Households (HH)	3358	5	per sack	16,790.00
Business Establishments (BE)	300	5	per sack	1,500.00
2. Information, Education and				
Communication Programs	3358	30	per HH & BE	100,740.00
3. Barangay MRF Maintenance & Operations	5	24,000	per brgy	120,000.00
4. Municipal MRF Maintenance & Operations				
Salaries and wages				
Supervisor	1	90,264		90,264.00
Sorters	3	31,200		93,600.00
Equipment maintenance	12	1,000	per mo	12,000.00
Building maintenance	12	1,000	per mo	12,000.00
Electricity and water	12	800	per mo	9,600.00
Supplies and materials	12	2,000	per mo	24,000.00
Uniforms, protective gear	5	1,000	per person	5,000.00
Communications	12	500	per mo	6,000.00
Sub-total				491,494.00

Stage 2: Collection and Transport

No. of working days per week	5			
No. of collection routes	5	(1 day per route)		
No. of shifts per day	1			
Ave working hours per shift	8			
Ave waste collected per week, cu m	153.13	(3 types of wastes)		
Total waste collected per year, cu.m.	7,693	=	2,331	tons

Cost Items	Units	Unit Cost*		Total
1. Salaries and wages				
Foreman, Salary Grade (SG) 15	1	164,671	per person	164,671
Drivers, SG 4	2	73,402	per person	146,804
Laborers, SG 3	4	67,966	per person	271,864
2. Electricity and Water	12	2,500	per mo	30,000
3. Rental of collection vehicle				0
4. Fuel, oil, tires, spare parts	1282	1,716	per truck trip	2,319,912
5. Vehicle repair and maintenance				162,500
6. Building maintenance	12	2,000	per mo	24,000
7. Supplies and materials	12	1,500	per mo	24,000
8. Uniforms, protective gear	7	1,000		7,000
9. Communications	12	1,500	per mo	18,000
Sub-total				3,168,751

Stage 3: Waste Disposal Operations and Management: Sanitary Landfill

Cost Items	Units	Unit Cost*		Total
1.Salaries and wages				
Foreman, SG 15	1	164,671	per person	164,671
Laborers, including Flagman, SG 3	4	67,966	per person	271,864
Security Services	12	12,000	per mo	144,000
2. Placing of soil/earth cover	12	37,500	per mo	450,000
3. Electricity and Water	12	3,000	per mo	36,000
4. Road Maintenance				50,000
5. Building maintenance	12	2,000	per mo	24,000

6. Supplies and materials	12	1,500	per mo	24,000
7. Uniforms, protective gear	5	1,000	per person	5,000
8. Communications	12	1,000	per mo	12,000
9. Sampling and Analysis of Groundwater	4	15,000	per qtr	60,000
10. Leachate collection, treatment and				300,000
disposal				
11. Disposable Field Equipment				10,000
12. Regulatory fees/permits				10,000
(includes fees for leachate treatment)				
Sub-total				1,561,535
TOTAL, PhP				**5,221,780**
TOTAL, USD				**98,246**
Cost Per cu.m.				
PhP				**678.81**
USD				**12.77**
Cost Per Ton				
PhP				**2,240.06**
USD				**42.15**
Cost Per HH & BE				
PhP				**1,427.50**
USD				**26.86**
Cost Per HH & BE Per Month				
PhP				**118.96**
USD				**2.24**

Scenario 3

Waste Collector and Collection Vehicle	Municipal Workers with 6 m^3 Garbage Truck
Waste Segregation at Source	Not required but biodegradables and recyclables shall be Brought to the municipal MRF near disposal site
Collection Frequency	Twice a week
Type/Location and Mode of Payment	Modified pick-up (along the road) and collection points And pay to the barangay treasurer

Stage 1: Waste Segregation and Reduction				
Cost Items	Units	Unit Cost*		Total
1. Supplies : used rice sacks				
Households (HH)	3358	5	per sack	16,790.00
Business Establishments (BE)	300	5	per sack	1,500.00
2. Information, Education and				
Communication Programs	3358	30	per HH & BE	100,740.00
3. Barangay MRF Maintenance & Operations	5	24,000	per brgy	120,000.00
4. Municipal MRF Maintenance & Operations				
Salaries and wages				
Supervisor	1	90,264		90,264.00
Sorters	3	62,400		187,200.00
Equipment maintenance	12	1,500	per mo	18,000.00
Building maintenance	12	1,000	per mo	12,000.00
Electricity and water	12	1,200	per mo	14,400.00
Supplies and materials	12	2,000	per mo	24,000.00
Uniforms, protective gear	5	1,000	per person	5,000.00

Communications	12	500	per mo	6,000.00
Sub-total				595,894.00

Stage 2: Collection and Transport

No. of working days per week	7			
No. of collection routes	4			
No. of shifts per day	1			
Ave working hours per shift	8			
Ave residual waste collected per week, cu m	153.13	(3 types of wastes)		
Ave residual waste collected per collection day	76.565	cu m		
Total Residual waste collected per year, cu.m.	7,693	=	2,331	tons

Cost Items	Units	Unit Cost*		Total
1. Salaries and wages				
Foreman, Salary Grade (SG) 15	1	164,671	per person	164,671
Drivers, SG 4	2	102,763	per person	205,526
Laborers, SG 3	4	95,153	per person	380,612
2. Electricity and Water	12	2,500	per mo	30,000
3. Rental of collection vehicle				0
4. Fuel, oil, tires, spare parts	641	3,432	per truck trip	2,319,912
5. Vehicle repair and maintenance				227,500
6. Building maintenance	12	2,000	per mo	24,000
7. Supplies and materials	12	1,800	per mo	24,000
8. Uniforms, protective gear	7	1,000	per person/yr	7,000
9. Communications	12	1,500	per mo	18,000
Sub-total				3,401,221

Stage 3: Waste Disposal Operations and Management: Sanitary Landfill

Cost Items	Units	Unit Cost*		Total
1.Salaries and wages				
Foreman, SG 15	1	164,671	per person	164,671
Laborers, including Flagman, SG 3	4	95,153	per person	380,612
Security Services	12	15,000	per mo	180,000
2. Placing of soil/earth cover	12	42,500	per mo	510,000
3. Electricity and Water	12	3,500	per mo	42,000
4. Road Maintenance				60,000
5. Building maintenance	12	2,000	per mo	24,000
6. Supplies and materials	12	1,800	per mo	24,000
7. Uniforms, protective gear	5	1,000	per person	5,000
8. Communications	12	1,200	per mo	14,400
9. Sampling and Analysis of Groundwater	4	15,000	per qtr	60,000
10. Leachate collection, treatment and				300,000
disposal				
11. Disposable Field Equipment				10,000
12. Regulatory fees/permits				10,000
(includes fees for leachate treatment)				
Sub-total				1,784,683
TOTAL, PhP				**5,781,798**
TOTAL, USD				**108,783**
Cost Per cu.m.				
PhP				**751.61**
USD				**14.14**

Cost Per Ton				
PhP				**2,480.30**
USD				**46.67**
Cost Per HH & BE				
PhP				**1,580.59**
USD				**29.74**
Cost Per HH & BE Per Month				
PhP				**131.72**
USD				**2.48**

APPENDIX C

Socio-Economic Characteristics of Respondents

Table 1. Socio-Economic Characteristics of Household Respondents

Characteristics	Minimum	Maximum	Mean
Age, years	18	89	40.5
Education: No of years of formal schooling	0	19	9.7
Household size	1	16	5
Ave. monthly income, pesos (all sources), PhP	2,500	55,000	10,108
Ave. monthly electric bill, PhP	0	4,500	319
Ave. monthly water bill, PhP	0	900	39.3
Ave. monthly telephone bill, PhP	0	8,000	239.3
Distance of house from main road, m	0 (along the road)	2,000	59.2
Years of living in Tuba	1	74	26.4

- 78 percent of the respondents are females.
- 87.1 percent of the respondents are married.
- 52.3 percent of the respondents are from Benguet province.
- 56 percent of the respondents are the sole-decision makers on household expenses.
- 48 percent of the respondents own the land where their house is
- When asked how much they would sell their house for, the average value of a house was PhP189,371.00. The maximum value of a house was PhP30 million.

Table 2. Socio-economic Characteristics of Business Establishments

Characteristics	Minimum	Maximum	Mean (PhP) (average)	Mean (USD) P53.15=1 USD
No. of years in operation in present location	.04	40	5.80	
No. of days open in a week	3	7	7	
No. and gender of management and workers				
Male	0	87	2	
Female	0	14	2	

Characteristics	Minimum	Maximum	Mean (PhP) (average)	Mean (USD) P53.15=1 USD
Total	0	101	3	
Monthly Gross Income, pesos	5,000	55,000	8,333	157
Monthly electric bill, pesos	0	30,000	1,181	22
Monthly water bill, pesos	0	8000	225	4
Monthly telephone bill, pesos	0	11,902	443	8
Expenditures for SWM per month, pesos	10	12,000	383	7
Distance of Establishment from main road, meters	0	400	25	
Floor area of stall or building of business establishment, sq. m	1.25	5,307	25	
Land area of business establishment, sq.m.	1.25	100,000	871	

- Ninety-six (96) percent of the respondents considered their business establishment as a small or medium-sized enterprise.
- 75.3 percent of the respondents said that they are the sole decision-makers on expenditures of their business establishments.
- 59.3 percent of the business establishments own the land they are occupying.
  - 70.7 percent of them own the stall or building that their business establishment is occupying.

ENDNOTES

[i] The Barangay is the smallest political unit in the Philippines. An elected barangay captain (or village chief) heads it.

[ii] The *Barangay* may impose fees for collection and segregation of biodegradable, compostable and reusable wastes from households, commerce, other sources of domestic wastes, and for the use of Barangay Material Recovery Facility (MRF). The respective SWM boards shall establish the computation of the fees. The manner of collection of the fees shall be dependent on the style of administration of respective Barangay Councils. The *municipal and city councils* may impose fees on the barangay MRFs for the collection and transport of non-recyclable and special wastes and for the disposal of these into the sanitary landfill. The level and procedure for exacting fees shall be defined by the Local SWM Board/Local SWM Cluster Board and supported by LGU ordinances. Payments shall be consistent with the accounting system of government, i.e., the Commission on Audit rules.

[iii] To support the devolution (political decentralization) of basic services from the national government to the LGUs and to minimize the need for aids and subsidies, RA 7160 institutionalized the sharing of national taxes among all government units from the national level to the smallest political subdivision. Known as the Internal Revenue Allotment (IRA) system, this calls for the automatic distribution of practically all national taxes based on a sharing formula among all government units. Financing SWM, as a devolved function, falls under the IRA, although this is not explicitly stated in RA 7160, according to the 1996 Feasibility Study for integrated SWM in BLIST, 1997.

[iv] 1 USD = PhP 53.15 (March 11, 2005)

[v] Philex Mining Corporation, in Tuba is responsible for the collection and disposal of the solid wastes only of its host barangay, Camp 3 (comprise 31 percent of the total households in Tuba).